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HICKORY-NUTS AND BUTTERNUTS.

By GRANT ALLEN.

THE tall choke-cherry tree in the corner of the meadow, near the hickory clump, is a favorite resort of all the fruit-eating birds in the township for half a mile around in every direction. To the judicious human palate, indeed, the flavor of choke-cherries is not exactly alluring or attractive; they have a disagreeable astringent tinge about their pulp that rather reminds one of alum or borax, and they are not sweet enough or luscious enough to be worth eating by people who have grapes and plums and peaches and apples and a dozen other cultivated fruits at easy command. But to the unsophisticated native birds it is quite clear that choke-cherries are rather a dainty and toothsome delicacy than otherwise; and one has only to look at the pretty berries in order to see that they deliberately lay themselves out to attract the favorable attention of these winged allies and visitors. The color of the choke-cherry shows at once that it wishes specially to challenge and allure the notice of the passer-by; its sweet pulp and nutritive qualities show that it means them to eat it, and so aid in dispersing its seed. For the actual, final end of the choke-cherry itself, of course, lies in the stone and its inclosed kernel; all the rest is merely the attractive covering which the plant gives in, as it were, to any friendly bird which will be kind enough to assist it in planting out its young seedlings under favorable circumstances for their future welfare. From time immemorial, those choke-cherries which best succeeded in enticing birds to swallow them, and ultimately to scatter their seeds, protected from injury by the hard and horny covering, have left the largest number of offspring to represent them, and so have survived most frequently, in the person of their descendants,

through the midst of that perpetual battling competition for the surface of the earth which goes on as fiercely between trees and plants as between men themselves or other animals. To put it briefly in a single phrase, we may say at once that a choke-cherry is one of the kind of fruits which want to be eaten, and sedulously lay themselves out beforehand for that very particular purpose.

But, when we turn from the choke-cherry to the hickory-trees which grow close by, we are brought face to face at once with another and very different state of things. If the choke-cherry wants to be eaten, the hickory-nut clearly wants to avoid that unpleasant and destructive predicament. In the first place, its color, instead of being brilliant and attractive, like that of most edible fruits, is very quiet and unobtrusive, being green while the nut still remains among the fresh foliage upon the branches of the tree, and pale brown when it falls upon the dead leaves and dry grasses that cover the damp and moldering ground beneath. If the hickory-nut were a conscious creature which deliberately wished to escape notice, these are the precise tactics which it would be likely to adopt for the sake of protection. Then, again, even when its disguise is pierced, and the nut, with its outer husk entire, is spied upon the ground by some hungry animal, it is coated with a very nasty, bitter covering, which effectually repels one from tearing it open readily with the teeth. We hand-wearing human beings, however, may perhaps manage to peel off the outer husk with a knife or stone, or, by more popular practice, to put a lot of the nuts together in a wheat-sack and thrash them out by stamping on them with our feet. Even so, however, we still have the actual woody inner nut-shell itself to deal with ; and unless we have arrived at that highest stage of civilization where nut-crackers are specially manufactured for us, to aid us in the struggle, we must crack them as best we may with our own precious and too unstable molars. But the native enemies of the hickory-nut—squirrels and the like—can not proceed in any such crunching and radically destructive fashion. They must bore a hole through the shell somewhere, and then extract the kernel little by little with their long, sharp, curved front teeth ; and, somehow, the arrangement of the nut inside the shell is of such sort as to render this work of gradual excavation as difficult as possible for the aggressive rodent. The kernel, instead of being all plain and straightforward, as in the acorn or the chestnut, is divided up and frittered away in little troublesome cricks and corners which seem as if they had been invented on purpose to prevent you from getting a single good bite out of the nut in any part whatsoever. Clearly, the hickory-nut is in all these respects the exact antipodes of the choke-cherry : it doesn't want to get eaten if it can by any means possibly help it.

This glimpse at the habits and manners of the hickory enables us to give a brief and intelligible answer to the question, What is a nut? The reply is, a fruit that tries by inconspicuous coloring and hard cov-

erings to escape being observed and eaten. The reason for such a disposition on the part of the nut is easy enough to understand. In the true or succulent fruits—fruits, that is to say, according to the popular and strictly practical sense of the word—the part we eat is not the actual seed itself, the cherry-stone or plum-stone or raspberry-kernels (which even if we swallow we do not digest), but a soft, pulpy covering which has nothing essential to do with the young embryo or future plantlet. In nuts, on the other hand, the part we eat is the actual kernel or embryo itself, with all the starches, oils, and other food-stuffs laid up for its use by the mother-plant. In the simplest and earliest form of seeds, like those of mustard and cress, for example, there is hardly any store of nutriment put away by the mother for the benefit of its struggling seedling. These poorly endowed plantlets have to open their green leaves to the sunlight the moment they begin to sprout, and, unless they can assimilate fresh food from the air immediately under that genial influence, they must die forthwith of pure inanition. But at a very early period in the evolutionary history of plants, some seeds began to be stored at the outset with small quantities of starch or oil, which enabled their budding embryos to push their heads higher above the surrounding vegetation without depending entirely for support on the mere hand-to-mouth system of daily gains. They had, so to speak, a small reserve of capital to live upon. Of course, this gave all such plants a great advantage over their neighbors in the struggle for existence: they could live under conditions where poorer seedlings would starve and die; and so, from generation to generation, those kinds which laid by most material survived the best on the average, till at last in many cases the embryo came to be very richly endowed indeed with starches, oils, gluten, and other valuable collected food-stuffs. This is especially the case with such seeds as wheat, barley, rye, oats, Indian corn, rice, peas, beans, lentils, and buckwheat.

Unfortunately for the plants, however, what will feed a seedling will feed an animal just as well: and so, exactly in proportion as the plants began to lay by food-stuffs for their own purposes in their embryos, did the animals begin to prey feloniously upon these convenient reservoirs of nutritious gums and starches. Not only does man eat the cereals and pulses, which are the richest in nutriment of almost all seeds, but many earlier and lower animals, such as harvest-mice, rats, chipmunks, deer, antelopes, horses, cow-kind, and even prairie-dogs commit great depredations upon them, both in the wild and cultivated states. Still more particularly have large numbers of animals, such as the squirrels, dormice, monkeys, parrots, nut-hatches, and even many grubs, taken to feeding off the fruits and seeds of forest-trees or woodland bushes. As a consequence, only those richly-stored seeds have for the most part survived which possessed some natural means of defense against their aggressive enemies; and in many instances

these means of defense have been multiplied over and over again for still greater precaution, so that the final outcome is a seed almost absolutely fortified against the onslaught of every possible aggressor.

In England, where there are only three native nut-eaters of any importance—the squirrel, the dormouse, and the nut-hatch—most of our indigenous trees have not found it necessary to arm themselves to any large extent against this class of depredators; and consequently there are only three kinds of nuts in the truly aboriginal English flora, namely, the beechnut, the acorn, and the filbert. Chestnuts, walnuts, and horse-chestnuts are cultivated in the British Isles to some slight extent, but they do not thrive, and the two former seldom produce fertile nuts. These three native English kinds, therefore, may be taken as good examples of very simple and undeveloped forms of nuts, far inferior to the most advanced American specimens. The acorn, in all countries, is comparatively little armed with protective coverings: it has only a thin shell, and is guarded from depredations mainly by its slightly bitter taste, as well as by its cup, or saucer, which acts as a barrier against the attacks of insects who try to lay their eggs at its tender base. Beechnuts have a rather more leathery shell, and are externally protected by their prickly husk, which makes them difficult for the delicate noses of squirrels to tackle as they grow upon their native boughs. Filberts, specially exposed to the attacks of the cunning dormouse and the persistent nut-hatch, are far more effectually guarded by a double coat-of-mail: their shell is solid and woody in texture, while their outer husk, which completely envelops them from stem to tip, is thickly sprinkled with stiff and annoying hairs, very painful to our human fingers, and still more so, no doubt, to the tender skin on the naked noses of the inquiring rodents.

None of these nuts belong to the same family as the hickory; they are all independent modifications of totally different forms, which have simultaneously hit on somewhat the same protective method. But on the Continent of Europe, where a larger number of nut-devouring animals are to be found, the hickory tribe is represented by the common walnut. Everybody must have noticed (in conducting his biological studies at dessert) that the distribution of the two lobes which make up the kernel in the walnut is extremely like that of the hickory; and the resemblance is equally close in all other important structural matters. The walnut shows decidedly more protective care in its coverings than any of the few and simple English nuts. Its outer husk is very bitter and nasty—so nasty that even a little of the flavoring matter off fresh walnuts clinging to one's fingers is enough to give a very unpleasant taste to any food one may touch afterward; and the inner shell, though evidently rendered easier to open for the lazy human consumers by being previously kiln-dried to preserve the kernel from decomposing, is in its native state extremely hard to crack, and

still harder to bore a hole through with teeth or bill, as any one may easily convince himself by trying to perform the feat with his own canines, or even with the point of his sharp pocket-knife. The walnut, in fact, is one of the hickory tribe, left behind in Europe and Western Asia; it ranges through Greece and Asia Minor, Lebanon and Persia, as far east as Cashmere; and never compelled by circumstances to acquire the very hard and stony coats of some among its American cousins.

In the New World, however, the walnut family has been driven by its pressing animal foes to adopt far more vigorous and active defensive tactics. The great American forests are the very paradise of endless hungry nut-eaters, from the common gray squirrel, the flying-squirrels, and the numerous other greedy rodents of the Northern plains, to the screaming parrots and powerful-billed monkeys of the tropical South American jungles. Where enemies are so numerous and so persistent, only the very hardest and best-protected nuts of all can survive; and so the nearest American representative of the European walnut is the butternut of Canada and the Northern States—a far more formidable and uncompromising mouthful to tackle than its easy-going Old World cousin. The outer husk of the butternut resembles pretty well that of the walnut; but its very stony shell is extremely difficult either to pierce or crack; the sharp ridges on its surface are naturally very baffling to the teeth of squirrels; and even when you have at last made a good hole in it, the inside can hardly be extracted in pieces of any bigness, because of the horny intervening ridges. This American walnut, in fact, is a far 'cuter and smarter form of seed-vessel than its effete European relative. There is every reason to believe, indeed, that the butternut is an advanced and improved descendant of the same primitive geological ancestor as the Greek walnut. Only, while the walnut has been standing still in peninsular Greece and Anatolia for innumerable generations, the butternut has been going ahead with true American impetuosity, inventing one new improvement or modification after another, till it has now attained to almost absolute perfection in its adaptation to its own peculiar walk in life.

Most of the American walnut kind, however, it must be candidly confessed, have not proceeded along the path of progress quite so quickly or so fully as the go-ahead and truly Yankee butternut. The majority of the best-known forms, such as the hickory, the bitter-nut, and pecan-nut, belong to the specially American group known as *Caryas*, with fruits usually smaller and less rich than the regular European walnuts. Even among this restricted group, however, there are some very instructive and interesting differences. For example, the true hickory-nut has a sweet and pleasant kernel, which makes it a great favorite with squirrels and boys. To protect itself against aggression, therefore, on the part of its four-footed foes—as to the

boys, it probably despairs—it has acquired a comparatively hard and woody shell, surrounded by a bitter and acrid husk. But its ally, the bitter-nut, has hit accidentally upon a still more excellent and cunning device: it has made the actual seed itself, the menaced kernel, a reservoir for its disagreeable bitter juice. Consequently, it needs much less external protection than the hickory, and every American boy knows well that its shell can be much more readily and easily broken than that of its sweeter relations. Why hickory-nuts should be less protected than butternuts, on the other hand, is a more difficult question; I incline to believe it is because of the greater number produced by each tree annually, so that, in spite of all the havoc wrought by squirrels and other depredators, enough must always have remained and sprouted to keep up the full normal number of the species from one generation to another.

Almost all nuts follow more or less one of these two protective types—the type of the hickory and the type of the bitter-nut—or even sometimes both together. In the tropics, where forestine animals are most developed, the nuts often reach a very high stage of evolution. The cocoanut is a familiar example: it has a soft outer husk, stringy and loose, which breaks and deadens its fall from the tall and graceful palm-trees on which it grows; and inside this yielding, protective mat-work, it has a very solid shell, inclosing the large and richly-stored kernel. But the cashew-nut is, perhaps, the most remarkable in some respects of any known example. It has taken most extraordinary pains to preserve its kernel from injury; and it has done so by a curious combination of the tactics peculiar to attractive fruits with those peculiar to repellent nuts. Its stalk swells out into a fleshy edible tuber, something like a pear in shape, and endowed with all the usual allurements of bright color and sweet taste. By this bribe, it entices the South American monkeys to pick and aid in dispersing its seed. But, at the same time, it carefully wraps up the nut itself in an acrid, pungent covering, and places it at the outer end of the pear-like stalk. Woe betide the adventurous monkey who tries to eat the inner kernel of this decidedly well-protected nut! The pungent juice of the rind not only burns his tongue and lips, but even removes the skin from his mischievous fingers as effectually as it could be removed by a cantharides-plaster. Hardly less quaint are the tactics adopted by the familiar pea-nut of our childhood, which is really the underground pod of a bean-like plant. This secretive vegetable has hit upon the device of producing its seeds on subterranean branches, and so escaping the notice of most open-air birds and mammals; though, in thus cunningly avoiding the Scylla of the upper earth, it has merely fallen against the Charybdis of grubbing pigs and burrowing rodents. The little English subterranean clover—I forget just now whether it grows in America, too, and Dr. Asa Gray's magnificent work is not at hand—has an even stranger plan for escaping from the sheep, on whose favor-

ite pastures it grows abundantly. It flowers above-ground, enticing the bees to fertilize its long, white, tubular blossoms by a copious store of pure and fragrant honey; but as soon as its wee pods have been fairly impregnated with pollen from a neighboring head, it screws its stalk down spirally into the ground, by the aid of some queer little corkscrew gimlets developed near the tip, and so buries the precious seeds well out of all danger from the close-nibbling teeth of its dreaded foes upon the sheep-walk.

Last of all, a few words must be said about the structural homologies of the hickory-nut. In principle, most fruits consist of three separate coats or layers, inclosing the seed or seeds. These three layers are very well seen in the peach, which consists, first, of an external skin; next, of a fleshy edible portion; and, finally, a hard inner covering—the stone—which contains the actual seed, or, as we oftener call it in practical language, the kernel. Now, in the hickory-nut, these three layers are still preserved, though in a very different apparent form: the outer surface, or membrane of the rind, answers to the skin of the peach; the bitter and stringy interior of the rind answers to the edible part of the peach; the nut-shell, or inner hard layer, answers to the stone of the peach; and the nut, or actual seed, answers to the kernel of the peach. This example shows very well by what slight changes in the development of various parts a fruit may seem to practical human eyes quite unlike some other one, which is, nevertheless, at bottom, layer for layer, absolutely identical with it. The only important difference, after all, between the peach and the hickory-nut is, that in the fruit the middle layer becomes soft, sweet, and succulent; while in the nut it becomes stringy, bitter, and nauseating. The almond even better enforces this simple evolutionary lesson; for it is, in reality, nothing more or less than a very dry and stringy peach—a very slightly divergent descendant of the same ancestor: its outermost layer answers exactly to the peach-skin; its tough, fibrous rind is the altered analogue of the flesh in the peach; and its nut (which part alone, shelled or unshelled, we generally see at table) is the equivalent of the peach-stone. But if you cut open a young walnut, a young hickory-nut, a young almond, a young peach, and a young plum, you will be surprised to find how exactly they answer to one another, part for part, and how entirely the conspicuous adaptive differences in the mature nuts or fruits are due to small varieties of development in the very latest stages of the ripening process. Pour a little sweet juice into the middle coat of the almond, and it would be a peach; add a little woody material to the cell-walls of the flesh in the peach, and it would be a very decent almond indeed.

THE GHOST OF RELIGION.

By FREDERIC HARRISON.

IN the January number of this Review * is to be found an article on Religion which has justly awakened a profound and sustained interest. The creed of Agnosticism was there formulated anew by the acknowledged head of the evolution philosophy, with a definiteness such as perhaps it never wore before. To my mind there is nothing in the whole range of modern religious discussion more cogent and more suggestive than the array of conclusions the final outcome of which is marshaled in those twelve pages. It is the last word of the Agnostic philosophy in its long controversy with Theology. That word is decisive, and it is hard to conceive how Theology can rally for another bout from such a *sorites* of dilemma as is there presented. My own humble purpose is not to criticise this paper, but to point its practical moral, and, if I may, to add to it a rider of my own. As a summary of philosophical conclusions on the theological problem, it seems to me frankly unanswerable. Speaking generally, I shall now dispute no part of it but one word, and that is the title. It is entitled "Religion." To me it is rather the ghost of religion. Religion as a living force lies in a different sphere.

The essay, which is packed with thought to a degree unusual even with Mr. Herbert Spencer, contains evidently three parts. The first (pp. 1–5) deals with the historical Evolution of Religion, of which Mr. Spencer traces the germs in the primitive belief in ghosts. The second (pp. 6–8) arrays the moral and intellectual dilemmas involved in all anthropomorphic theology into one long catena of difficulty, out of which it is hard to conceive any free mind emerging with success. The third part (pp. 8–12) deals with the evolution of religion in the future, and formulates, more precisely than has ever yet been effected, the positive creed of Agnostic philosophy.

Has, then, the Agnostic a positive creed? It would seem so; for Mr. Spencer brings us at last "to the one absolute certainty, the presence of an Infinite and Eternal Energy, from which all things proceed." But let no one suppose that this is merely a new name for the Great First Cause of so many theologies and metaphysics. In spite of the capital letters, and the use of theological terms as old as Isaiah or Athanasius, Mr. Spencer's Energy has no analogy with God. It is Eternal, Infinite, and Incomprehensible; but still it is not He, but It. It remains always Energy, Force, nothing anthropomorphic; such as electricity, or anything else that we might conceive as the ultimate basis of all the physical forces. None of the positive attributes which

* See "Popular Science Monthly" for January, 1884.

have ever been predicated of God can be used of this Energy. Neither goodness, nor wisdom, nor justice, nor consciousness, nor will, nor life, can be ascribed, even by analogy, to this Force. Now a force to which we can not apply the ideas of goodness, wisdom, justice, consciousness, or life, any more than we can to a circle, is certainly not God, has no analogy with God, nor even with what Pope has called the "Great First Cause, least understood." It shares some of the negative attributes of God and First Cause, but no positive one. It is, in fact, only the Unknowable a little more defined; though I do not remember that Mr. Spencer, or any evolution philosopher, has ever formulated the Unknowable in terms with so deep a theological ring as we hear in the phrase "Infinite and Eternal Energy, from which all things proceed."

The terms do seem, perhaps, rather needlessly big and absolute. And fully accepting Mr. Spencer's logical canons, one does not see why it should be called an "absolute certainty." "Practical belief" satisfies me; and I doubt the legitimacy of substituting for it "absolute certainty." "Infinite" and "Eternal," also, can mean to Mr. Spencer nothing more than "to which we know no limits, no beginning or end," and, for my part, I prefer to say this. Again, "an Energy" —why AN Energy? The Unknowable may certainly consist of more than one energy. To assert the presence of one uniform energy is to profess to know something very important about the Unknowable: that it is homogeneous, and even identical, throughout the Universe. And then, "from which all things proceed" is perhaps a rather equivocal reversion to the theologic type. In the Athanasian Creed the Third Person "proceeds" from the First and the Second. But this process has always been treated as a mystery; and it would be safer to avoid the phrases of mysticism. Let us keep the old words, for we all mean much the same thing; and I prefer to put it thus. All observation and meditation, Science and Philosophy, bring us "to the *practical belief* that man is ever in the presence of *some energy or energies*, of which he knows nothing, and to which therefore he would be wise to assign no limits, conditions, or functions." This is, doubtless, what Mr. Spencer himself means. For my part, I prefer his old term, the Unknowable. Though I have always thought that it would be more philosophical not to assert of the Unknown that it is Unknowable. And, indeed, I would rather not use the capital letter, but stick literally to our evidence, and say frankly "the unknown."

Thus viewed, the attempt, so to speak, to put a little unction into the Unknowable is hardly worth the philosophical inaccuracy it involves; and such is the drawback to any use of picturesque language. So stated, the positive creed of Agnosticism still retains its negative character. It has a series of propositions and terms, every one of which is a negation. A friend of my own, who was much pressed to say how much of the Athanasian Creed he still accepted, once said that he clung to the idea "that there was a sort of a something." In

homely words such as the unlearned can understand, that is precisely what the religion of the Agnostic comes to, "the belief that there is a sort of a something about which we can know nothing."

Now let us profess that, as a philosophical answer to the theological problem, that is entirely our own position. The Positivist answer is of course the same as the Agnostic answer. Why, then, do we object to be called Agnostics? Simply because Agnostic is only dog-Greek for "don't know," and we have no taste to be called "don't knows." The "Spectator" calls us Agnostics, but that is only by way of prejudice. Our religion does not consist in a comprehensive negation; we are not forever replying to the theological problem; we are quite unconcerned by the theological problem, and have something that we do care for, and do know. Englishmen are Europeans, and many of them are Christians, and they usually prefer to call themselves Englishmen, Christians, or the like, rather than non-Asiatics or anti-Mahometans. Some people still prefer to call themselves Protestants rather than Christians, but the taste is dying out, except among Irish Orangemen, and even the Nonconformist newspaper has been induced by Mr. Matthew Arnold to drop its famous motto, "The dissidence of Dissent, and the Protestantism of the Protestant religion." For a man to say that his religion is Agnosticism is simply the skeptical equivalent of saying that his religion is Protestantism. Both mean that his religion is to deny and to differ. But this is not religion. The business of religion is to affirm and to unite, and nothing can be religion but that which at once affirms truth and unites men.

The purpose of the present paper is to show that Agnosticism, though a valid and final answer to the theological or ontological problem—"What is the ultimate cause of the world and of man?"—is not a religion nor the shadow of a religion. It offers none of the rudiments or elements of religion, and religion is not to be found in that line at all. It is the mere disembodied spirit of dead religion: as we said at the outset, it is the ghost of religion. Agnosticism, perfectly legitimate as the true answer of science to an effete question, has shown us that religion is not to be found anywhere within the realm of Cause. Having brought us to the answer, "no cause that we know of," it is laughable to call that negation religion. Mr. Mark Pattison, one of the acutest minds of modern Oxford, rather oddly says that the idea of deity has now been "defecated to a pure transparency." The evolution philosophy goes a step further and defecates the idea of cause to a pure transparency. Theology and ontology alike end in the Everlasting No with which science confronts all their assertions. But how whimsical is it to tell us that religion, which can not find any resting-place in theology or ontology, is to find its true home in the Everlasting No! That which is defecated to a pure transparency can never supply a religion to any human being but a philosopher constructing a system. It is quite conceivable that religion is to end with theology, and both

might in the course of evolution become an anachronism. But if religion there is still to be, it can not be found in this No-man's-land and Know-nothing creed. Better bury religion at once than let its ghost walk uneasy in our dreams.

The true lesson is that we must hark back, and leave the realm of Cause. The accident of religion has been mistaken for the essence of religion. The essence of religion is not to answer a question, but to govern and unite men and societies by giving them common beliefs and duties. Theologies tried to do this, and long did it, by resting on certain answers to certain questions. The progress of thought has upset one answer after another, and now the final verdict of philosophy is that all the answers are unmeaning, and that no rational answer can be given. It follows then that questions and answers, both but the accident of religion, must both be given up. A base of belief and duty must be looked for elsewhere, and when this has been found, then again religion will succeed in governing and uniting men. Where is this base to be found? Since the realm of Cause has failed to give us foothold, we must fall back upon the realm of Law—social, moral, and mental law, and not merely physical. Religion consists, not in answering certain questions, but in making men of a certain quality. And the law, moral, mental, social, is pre-eminently the field wherein men may be governed and united. Hence to the religion of Cause there succeeds the religion of Law. But the religion of Law or Science is Positivism.

It is no part of my purpose to criticise Mr. Spencer's memorable essay, except so far as it is necessary to show that that which is a sound philosophical conclusion is not religion, simply by reason that it relates to the subject-matter of theology. But a few words may be suffered as to the historical evolution of religion. To many persons it will sound rather whimsical, and possibly almost a sneer, to trace the germs of religion to the ghost-theory. Our friends of the Psychical Research will prick up their ears, and expect to be taken *au grand sérieux*. But the conception is a thoroughly solid one, and of most suggestive kind. Beyond all doubt, the hypothesis of quasi-human immaterial spirits working within and behind familiar phenomena did take its rise from the idea of the other self which the imagination continually presents to the early reflections of man. And, beyond all doubt, the phenomena of dreams, and the gradual construction of a theory of ghosts, is a very impressive and vivid form of the notion of the other self. It would, I think, be wrong to assert that it is the only form of the notion, and one can hardly suppose that Mr. Spencer would limit himself to that. But, in any case, the construction of a coherent theory of ghosts is a typical instance of a belief in a quasi-human spirit-world. Glorify and amplify this idea, and apply it to the whole of Nature, and we get a god-world, a multitude of superhuman divine spirits.

That is the philosophical explanation of the rise of theology, of the peopling of Nature with divine spirits. But does it explain the rise of Religion? No, for theology and religion are not conterminous. Mr. Spencer has unwittingly conceded to the divines that which they assume so confidently—that theology is the same thing as religion, and that there was no religion at all until there was a belief in superhuman spirits within and behind Nature. This is obviously an oversight. We have to go very much further back for the genesis of religion. There were countless centuries of time, and there were, and there are, countless millions of men for whom no doctrine of superhuman spirits ever took coherent form. In all these ages and races, probably by far the most numerous that our planet has witnessed, there was religion in all kinds of definite form. Comte calls it Fetichism—terms are not important: roughly, we may call it Nature-worship. The religion in all these types was the belief and worship not of spirits of any kind, not of any immaterial, imagined being *inside* things, but of the actual visible things themselves—trees, stones, rivers, mountains, earth, fire, stars, sun, and sky. Some of the most abiding and powerful of all religions have consisted in elaborate worship of these physical objects treated frankly as physical objects, without trace of ghost, spirit, or god. To say nothing of fire-worship, river, and tree-worship, the venerable religion of China, far the most vast of all systematic religions, is wholly based on reverence for Earth, Sky, and ancestors treated objectively, and not as the abode of subjective immaterial spirits.

Hence the origin of religion is to be sought in the countless ages before the rise of theology; before spirits, ghosts, or gods ever took definite form in the human mind. The primitive uncultured man frankly worshiped external objects in love and in fear, ascribing to them quasi-human powers and feelings. All that we read about Animism, ghosts, spirits, and universal ideas of godhead in this truly primitive stage are metaphysical assumptions of men trying to read the ideas of later epochs into the facts of an earlier epoch. Nothing is more certain than that man everywhere started with a simple worship of natural objects. And the bearing of this on the future of religion is decisive. The religion of man in the vast cycles of primitive ages was reverence for Nature as influencing Man. The religion of man in the vast cycles that are to come will be the reverence for Humanity as supported by Nature. The religion of man in the twenty or thirty centuries of Theology was reverence for the assumed authors or controllers of Nature. But, that assumption having broken up, religion does not break up with it. On the contrary, it enters on a far greater and more potent career, inasmuch as the natural emotions of the human heart are now combined with the certainty of scientific knowledge. The final religion of enlightened man is the systematized and scientific form of the spontaneous religion of natural man. Both

rest on the same elements—belief in the Power which controls his life, and grateful reverence for the Power so acknowledged. The primitive man thought that Power to be the object of Nature affecting Man. The cultured man knows that Power to be Humanity itself, controlling and controlled by Nature according to natural law. The transitional and perpetually changing creed of Theology has been an interlude. Agnosticism has uttered its epilogue. But Agnosticism is no more religion than differentiation or the nebular hypothesis is religion.

We have only to see what are the elements and ends of religion to recognize that we can not find it in the negative and the unknown. In any reasonable use of language religion implies some kind of belief in a Power outside ourselves, some kind of awe and gratitude felt for that Power, some kind of influence exerted by it over our lives. There are always in some sort these three elements—belief, worship, conduct. A religion which gives us nothing in particular to believe, nothing as an object of awe and gratitude, which has no special relation to human duty, is not a religion at all. It may be formula, a generalization, a logical postulate; but it is not a religion. The universal presence of the unknowable (or rather of the unknown) substratum is not a religion. It is a logical postulate. You may call it, if you please, the first axiom of science, a law of the human mind, or perhaps better the universal postulate of philosophy. But try it by every test which indicates religion and you will find it wanting.

The points which the Unknowable has in common with the object of any religion are very slight and superficial. As the universal substratum it has some analogy with other superhuman objects of worship. But Force, Gravitation, Atom, Undulation, Vibration, and other abstract notions have much the same kind of analogy, but nobody ever dreamed of a religion of gravitation, or the worship of molecules. The Unknowable has managed to get itself spelt with a capital *U;* but Carlyle taught us to spell the Everlasting No with capitals also. The Unknowable is no doubt mysterious, and Godhead is mysterious. It certainly appeals to the sense of wonder, and the Trinity appeals to the sense of wonder. It suggests vague and infinite extension, as does the idea of deity: but then Time and Space equally suggest vague and infinite extension. Yet no one but a delirious Kantist ever professed that Time and Space were his religion. These seem all the qualities which the Unknowable has in common with objects of worship—ubiquity, mystery, and immensity. But these qualities it shares with some other postulates of thought.

But try it by all the other recognized tests of religion. Religion is not made up of wonder, or of a vague sense of immensity, unsatisfied yearning after infinity. Theology, seeking a refuge in the unintelligible, has no doubt accustomed this generation to imagine that a yearning after infinity is the sum and substance of religion. But that

is a metaphysical disease of the age. And there is no reason that philosophers should accept this hysterical piece of transcendentalism, and assume that they have found the field of religion when they have found a field for unquenchable yearning after infinity. Wonder has its place in religion, and so has mystery ; but it is a subordinate place. The roots and fibers of religion are to be found in love, awe, sympathy, gratitude, consciousness of inferiority and of dependence, community of will, acceptance of control, manifestation of purpose, reverence for majesty, goodness, creative energy, and life. Where these things are not, religion is not.

Let us take each one of these three elements of religion—belief, worship, conduct—and try them all in turn as applicable to the Unknowable. How mere a phrase must any religion be of which neither belief, nor worship, nor conduct can be spoken ! Imagine a religion which can have no believers, because, *ex hypothesi*, its adepts are forbidden to believe anything about it. Imagine a religion which excludes the idea of worship, because its sole dogma is the infinity of Nothingness. Although the Unknowable is logically said to be Something, yet the something of which we neither know nor conceive anything is practically nothing. Lastly, imagine a religion which can have no relation to conduct ; for obviously the Unknowable can give us no intelligible help to conduct, and *ex vi termini* can have no bearing on conduct. A religion which could not make any one any better, which would leave the human heart and human society just as it found them, which left no foothold for devotion, and none for faith ; which could have no creed, no doctrines, no temples, no priests, no teachers, no rites, no morality, no beauty, no hope, no consolation ; which is summed up in one dogma—the Unknowable is everywhere, and Evolution is its prophet—this is indeed "to defecate religion to a pure transparency."

The growing weakness of religion has long been that it is being thrust inch by inch off the platform of knowledge ; and we watch with sympathy the desperate efforts of all religious spirits to maintain the relations between knowledge and religion. And now it hears the invitation of Evolution to abandon the domain of knowledge, and to migrate to the domain of no-knowledge. The true Rock of Ages, says the philosopher, is the Unknowable. To the eye of Faith all things are henceforth *ἀκαταληψία*, as Cicero calls it. The paradox would hardly be greater if we were told that true religion consisted in unlimited Vice.

What is religion for ? Why do we want it ? And what do we expect it to do for us ? If it can give us no sure ground for our minds to rest on, nothing to purify the heart, to exalt the sense of sympathy, to deepen our sense of beauty, to strengthen our resolves, to chasten us into resignation, and to kindle a spirit of self-sacrifice—what is the good of it ? The Unknowable, *ex hypothesi*, can do none of these

things. The object of all religion, in any known variety of religion, has invariably had some quasi-human and sympathetic relation to man and human life. It follows from the very meaning of religion that it could not effect any of its work without such quality or relation. It would be hardly sane to make a religion out of the Equator or the Binomial theorem. Whether it was the religion of the lowest savage, of the Polytheist, or of the Hegelian Theist; whether the object of the worship were a river, the Moon, the Sky, Apollo, Thor, God, or First Cause, there has always been some chain of sympathy—influence on the one side, and veneration on the other. However rudimentary, there must be a belief in some Power influencing the believer, and whose influence he repays with awe and gratitude and a desire to conform his life thereto. But to make a religion out of the Unknowable is far more extravagant than to make it out of the Equator. We know something of the Equator; it influences seamen, equatorial peoples, and geographers not a little, and we all hesitate, as was once said, to speak disrespectfully of the Equator. But would it be blasphemy to speak disrespectfully of the Unknowable? Our minds are a blank about it. As to acknowledging the Unknowable, or trusting in it, or feeling its influence over us, or paying gratitude to it, or conforming our lives to it, or looking to it for help—the use of such words about it is unmeaning. We can wonder at it, as the child wonders at the "twinkling star," and that is all. It is a religion only to stare at.

Religion is not a thing of star-gazing and staring, but of life and action. And the condition of any such effect on our lives and our hearts is some sort of vital quality in that which is the object of the religion. The mountain, sun, or sky which untutored man worships is thought to have some sort of vital quality, some potency of the kind possessed by organic beings. When mountain, sun, and sky cease to have this vital potency, educated man ceases to worship them. Of course all sorts and conditions of divine spirits are assumed in a pre-eminent degree to have this quality, and hence the tremendous force exerted by all religions of divine spirits. Philosophy and the euthanasia of theology have certainly reduced this vital quality to a minimum in our day, and I suppose Dean Mansel's Bampton Lectures touched the low-water mark of vitality as predicated of the Divine Being. Of all modern theologians, the Dean came the nearest to the Evolution negation. But there is a gulf which separates even his all-negative deity from Mr. Spencer's impersonal, unconscious, unthinking, and unthinkable Energy.

Knowledge is of course wholly within the sphere of the Known. Our moral and social science is, of course, within the sphere of knowledge. Moral and social well-being, moral and social education, progress, perfection, naturally rest on moral and social science. Civilization rests on moral and social progress. And happiness can only be secured by both. But if religion has its sphere in the Unknown and Unknow,

able, it is thereby outside all this field of the Known. In other words, Religion (of the Unknowable type) is *ex hypothesi* outside the sphere of knowledge, of civilization, of social discipline, of morality, of progress, and of happiness. It has no part or parcel in human life. It fills a brief and mysterious chapter in a system of philosophy.

By their fruits you shall know them is true of all sorts of religion. And what are the fruits of the Unknowable but the Dead Sea apples? Obviously it can teach us nothing, influence us in nothing, for the absolutely incalculable and unintelligible can give us neither ground for action nor thought. Nor can it touch any one of our feelings, but that of wonder, mystery, and sense of human helplessness. Helpless, objectless, apathetic wonder at an inscrutable infinity may be attractive to a metaphysical divine: but it does not sound like a working force in the world. Does the Evolutionist commune with the Unknowable in the secret silence of his chamber? Does he meditate on it, saying, in quietness and confidence shall be your strength? One would like to see the new *Imitatio Ignoti*. It was said of old, *Ignotum omne pro magnifico*. But the new version is to be *Ignotum omne pro divino*.

One would like to know how much of the Evolutionist's day is consecrated to seeking the Unknowable in a devout way, and what the religious exercises might be. How does the man of science approach the All-Nothingness? and the microscopist, and the embryologist, and the vivisectionist? What do they learn about it, what strength or comfort does it give them? Nothing—nothing: it is an ever-present conundrum to be everlastingly given up, and perpetually to be asked of one's self and one's neighbors, but without waiting for the answer. Tantalus and Sisyphus bore their insoluble tasks, and the Evolutionist carries about his riddle without an answer, his unquenchable thirst to know that which he only knows he can never know. *Quisque suos patimur Manes*. But Tantalus and Sisyphus called it Hell and the retribution of the Gods. The Evolutionist calls it Religion, and one might almost say Paradise.

A child comes up to our Evolutionist friend, looks up in his wise and meditative face, and says, "O wise and great Master, what is religion?" And he tells that child, It is the presence of the Unknowable. "But what," asks the child, "am I to believe about it?" "Believe that you can never know anything about it." "But how am I to learn to do my duty?" "Oh! for duty you must turn to the known, to moral and social science." And a mother wrung with agony for the loss of her child, or the wife crushed by the death of her children's father, or the helpless and the oppressed, the poor and the needy, men, women, and children, in sorrow, doubt, and want, longing for something to comfort them and to guide them, something to believe in, to hope for, to love, and to worship—they come to our philosopher and they say, "Your men of science have routed our priests, and have silenced our old teachers. What religious faith do you give us in its

place?" And the philosopher replies (his full heart bleeding for them) and he says, "Think on the Unknowable."

And in the hour of pain, danger, or death, can any one think of the Unknowable, hope anything of the Unknowable, or find any consolation therein? Altars might be built to some Unknown God, conceived as a real being, knowing us, though not known by us yet. But altars to the unknowable infinity, even metaphorical altars, are impossible, for this unknown can never be known, and we have not the smallest reason to imagine that it either knew us, or affects us, or anybody, or anything. As the Unknowable can not bring men together in a common belief, or for common purposes, or kindred feeling, it can no more unite men than the precession of the equinoxes can unite them. So there can never be congregations of Unknowable worshipers, nor churches dedicated to the Holy Unknowable, nor images nor symbols of the Unknowable mystery. Yes! there is one symbol of the Infinite Unknowable, and it is perhaps the most definite and ultimate word that can be said about it. The precise and yet inexhaustible language of mathematics enables us to express, in a common algebraic formula, the exact combination of the unknown raised to its highest power of infinity. That formula is (x^n), and here we have the beginning and perhaps the end of a symbolism for the religion of the Infinite Unknowable. Schools, academies, temples of the Unknowable, there can not be. But where two or three are gathered together to worship the Unknowable, there the algebraic formula may suffice to give form to their emotions: they may be heard to profess their unwearying belief in (x^n), even if no weak brother with ritualist tendencies be heard to cry, "O x^n, love us, help us, make us one with thee!"

These things have their serious side, and suggest the real difficulties in the way of the theory. The alternative is this: Is religion a mode of answering a question in ontology, or is it an institution for affecting human life by acting on the human spirit? If it be the latter, then there can be no religion of the Unknowable, and the sphere of religion must be sought elsewhere in the Knowable. We may accept with the utmost confidence all that the evolution philosophy asserts and denies as to the perpetual indications of an ultimate energy, omnipresent and unlimited, and, so far as we can see, of inscrutable mysteriousness. That remains an ultimate scientific idea, one no doubt of profound importance. But why should this idea be dignified with the name of religion, when it has not one of the elements of religion, except infinity and mystery? The hallowed name of religion has meant, in a thousand languages, man's deepest convictions, his surest hopes, the most sacred yearnings of his heart, that which can bind in brotherhood generations of men, comfort the fatherless and the widow, uphold the martyr at the stake, and the hero in his long battle. Why retain this magnificent word, rich with the associations of all that is great, pure, and lovely in human nature, if it is to be henceforth limited to

an idea, that can only be expressed by the formula (x^n) ; and which by the hypothesis can have nothing to do with either knowledge, belief, sympathy, hope, life, duty, or happiness? It is not religion, this. It is a logician's artifice to escape from an awkward dilemma.

One word in conclusion to those who would see religion a working reality, and not a logical artifice. The startling *reductio ad absurdum* of relegating religion to the unknowable is only the last step in the process which has gradually reduced religion to an incomprehensible *minimum*. And this has been the work of theologians obstinately fighting a losing battle, and withdrawing at every defeat into a more impregnable and narrower fastness. They have thrown over one after another the claims of religion and the attributes of divinity. They are so hopeless of continuing the contest on the open field of the known that they more and more seek to withdraw to the cloud-world of the transcendental. They are so terribly afraid of an anthropomorphic God that they have sublimated him into a metaphorical expression—"defecated the idea to a pure transparency," as one of the most eminent of them puts it. Dean Mansel is separated from Mr. Spencer by degree, not in kind. And now they are pushed by Evolution into the abyss, and are solemnly assured that the reconciliation of Religion and Science is effected by this religion of the Unknowable—this *chimæra bombinans in vacuo*. Their Infinites and their Incomprehensibles, their Absolute and their Unconditioned, have brought them to this. It is only one step from the sublime to the unknowable.

Practically, so far as it affects the lives of men and women in the battle of life, the absolute and Unconditioned Godhead of learned divines is very much the same thing as the Absolute Unknowable. You may rout a logician by a "pure transparency," but you can not check vice, crime, and war by it, nor train up men and women in holiness and truth. And the set of all modern theology is away from the anthropomorphic and into the Absolute. In trying to save a religion of the spirit-world, theologians are abandoning all religion of the real world ; they are turning religion into formulas and phrases, and are taking out of it all power over life, duty, and society.

I say, in a word, unless religion is to be anthropomorphic, there can be no working religion at all. How strange is this new cry, sprung up in our own generation, that religion is dishonored by being anthropomorphic! Fetichism, Polytheism, Confucianism, Mediæval Christianity, and Bible Puritanism have all been intensely anthropomorphic, and all owed their strength and dominion to that fact. You can have no religion without kinship, sympathy, relation of some human kind between the believer, worshiper, servant, and the object of his belief, veneration, and service. The Neo-Theisms have all the same mortal weakness that the Unknowable has. They offer no kinship, sympathy, or relation whatever between worshiper and worshiped. They, too, are logical formulas begotten in controversy,

dwelling apart from man and the world. If the formula of the Unknowable is (x^n), or the Unknown raised to infinity, theirs is (nx), some unknown expression of Infinity. Neither (x^n) nor (nx) will ever make good men and women.

If we leave the region of formulas and go back to the practical effect of religion on human conduct, we must be driven to the conclusion that the future of religion is to be, not only what every real religion has ever been, anthropomorphic—but frankly anthropic. The attempted religion of Spiritism has lost one after another every resource of a real religion, until *risu solvuntur tabulæ*, and it ends in a religion of Nothingism. It is the Nemesis of Faith in spiritual abstractions and figments. The hypothesis has burst, and leaves the Void. The future will have then to return to the Knowable and the certainly known, to the religion of Realism. It must give up explaining the Universe, and content itself with explaining human life. Humanity is the grandest object of reverence within the region of the real and the known, Humanity with the World on which it rests as its base and environment. Religion, having failed in the superhuman world, returns to the human world. Here religion can find again all its certainty, all its depth of human sympathy, all its claim to command and reward the purest self-sacrifice and love. We can take our place again with all the great religious spirits who have ever molded the faith and life of men, and we find ourselves in harmony with the devout of every faith who are manfully battling with sin and discord. The way for us is the clearer as we find the religion of Spiritism, in its long and restless evolution of thirty centuries, ending in the legitimate deduction, the religion of the Unknowable, a paradox as memorable as any in the history of the human mind. The alternative is very plain. Shall we cling to a religion of Spiritism when Philosophy is whittling away spirit to Nothing? Or shall we accept a religion of Realism, where all the great traditions and functions of religion are retained unbroken?—*Nineteenth Century.*

RETROGRESSIVE RELIGION.*

By HERBERT SPENCER.

IN days when dueling was common, and its code of ceremonial well elaborated, a deadly encounter was preceded by a polite salute. Having by his obeisance professed to be his antagonist's very humble servant, each forthwith did his best to run him through the body.

* Excepting its last section, this article had been written, and part of it sent to the printers, by the 30th of May; and, consequently, before I saw the article of Sir James Stephen, published in the "Nineteenth Century" for June, 1884. Hence the fact that

This usage is recalled to me by the contrast between the compliment with which Mr. Harrison begins his article, "The Ghost of Religion," and the efforts he afterward makes to destroy, in the brilliant style habitual with him, all but the negative part of that which he applauds. After speaking with too-flattering eulogy of the mode in which I have dealt with current theological doctrines, he does his best, amid the flashes of wit coming from its polished surface, to pass the sword of his logic through the ribs of my argument, and let out its vital principle—that element in it which is derived from the religious ideas and sentiments that have grown up along with human evolution, but which is inconsistent with the creed Mr. Harrison preaches.

So misleading was the professed agreement with which he commenced his article, that, as I read on, I was some time in awakening to the fact that I had before me not a friend, but, controversially speaking, a determined enemy, who was seeking to reduce, as he would say to a ghostly form, that surviving element of religion which, as I had contended, Agnosticism contains. Even when this dawned on me, the suavity of Mr. Harrison's first manner continued so influential that I entertained no thought of defending myself. It was only after perceiving that what he modestly calls "a rider" was described by one journal as "a criticism keen, trenchant, destructive," while by some other journals kindred estimates of it were formed, that I decided to make a reply as soon as pending engagements allowed.

Recognizing, then, the substance of Mr. Harrison's article as being an unsparing assault on the essential part of that doctrine which I have set forth, I shall here not scruple to defend it in the most effective way I can: not allowing the laudation with which Mr. Harrison prefaces his ridicule, to negative such rejoinders, incisive as I can make them, as will best serve my purpose.

A critic who, in a recent number of the "Edinburgh Review," tells the world in very plain language what he thinks about a book of mine, and who has been taken to task by the editor of "Knowledge" for his injustice, refers to Mr. Harrison (whom he describes in felicitous phrase as looking at me from "a very opposite pole") as being, on one

only in its last section have I been able (without undue interruption of my argument) to refer to points in Sir James Stephen's criticism.

Concerning his criticism generally, I may remark that it shows me how dangerous it is to present separately, in brief space, conclusions which it has taken a large space to justify. Unhappily, twelve pages do not suffice for adequate exposition of a philosophical system, or even of its bases; and misapprehension is pretty certain to occur if a statement contained in twelve pages is regarded as more than a rude outline. If Sir James Stephen will refer to §§ 49–207 of the "Principles of Sociology," occupying 350 pages, I fancy that instead of seeming to him "weak," the evidence there given of the origin of religious ideas will seem to him very strong; and I venture also to think that if he will refer to "First Principles," §§ 24–26, § 50, §§ 58–61, § 194, and to the "Principles of Psychology," §§ 347–351, he may find that what he thinks "an unmeaning playing with words" has more meaning than appears at first sight.

point, in agreement with him.* But for this reference it would not have occurred to me to associate in thought Mr. Harrison's criticisms with those of the Edinburgh Reviewer; but now that comparison is suggested, I am struck by the fact that Mr. Harrison's representations of my views diverge from the realities no less widely than those of a critic whose antagonism is unqualified, and whose animus is displayed in his first paragraph.

So anxious is Mr. Harrison to show that the doctrine he would discredit has no kinship to the doctrines called religious, that he will not allow me, without protest, to use the language needed for conveying my meaning. The expression "an Infinite and Eternal Energy from which all things proceed," he objects to as being "perhaps a rather equivocal reversion to the theologic type;" and he says this because "in the Athanasian Creed the Third Person 'proceeds' from the First and the Second." It is hard that I should be debarred from thus using the word by this preceding use. Perhaps Mr. Harrison will be surprised to learn that, as originally written, the expression ran —"an Infinite and Eternal Energy by which all things are created and sustained;" and that in the proof I struck out the last clause because, though the words did not express more than I meant, the ideas associated with them might mislead, and there might result such an insinuation as that which Mr. Harrison makes. The substituted expression, which embodies my thought in the most colorless way, I can not relinquish because he does not like it—or rather, indeed, because he does not like the thought itself. It is not convenient to him that the Unknowable, which he repeatedly speaks of as a pure negation, should be represented as that through which all things exist. And, indeed, it would be inconvenient for him to recognize this; since the recognition would prevent him from asserting that "none of the positive attributes which have ever been predicated of God can be used of this Energy."

Not only does he, as in the last sentence, negatively misdescribe the character of this Energy, but he positively misdescribes it. He says—"It remains always Energy, Force: nothing anthropomorphic; such as electricity, or anything else that we might conceive as the ultimate basis of all the physical forces." Now, on page 9 of the essay Mr. Harrison criticises, there occurs the sentence—"The final outcome of that speculation commenced by the primitive man, is that the Power manifested throughout the Universe distinguished as material, is the same power which in ourselves wells up under the form of consciousness;" and on page 11 it is said that "this necessity we are under, to think of the external energy in terms of the internal energy, gives rather a spiritualistic than a materialistic aspect to the Universe." Does he really think that the meaning of these sentences is conveyed by comparing the ultimate energy to "electricity"? And does he

* "Knowledge," March 14, 1884.

think this in face of the statement on page 11 that "phenomenal manifestations of this ultimate energy can in no wise show us what it is?" Surely that which is described as the substratum at once of material and mental existence, bears toward us and toward the Universe, a relation utterly unlike that which electricity bears to the other physical forces.

Persistent thinking along defined grooves, causes inability to get out of them; and Mr. Harrison, in more than one way, illustrates this. So completely is his thought molded to that form of phenomenalism entertained by M. Comte, that, in spite of repeated denials of it, he ascribes it to me; and does this in face of the various presentations of an opposed phenomenalism, which I have given in the article he criticises and elsewhere. Speaking after his lively manner of the Unknown Cause as "an ever-present conundrum to be everlastingly given up," he asks—"How does the man of science approach the All-Nothingness?" Now M. Comte describes Positivism as becoming perfect when it reaches the power to "se représenter tous les divers phénomènes observables comme des cas particuliers d'un seul fait général . . . considérant comme absolument inaccessible, et vide de sens pour nous, la recherche de ce qu'on appelle les *causes*, soit premières, soit finales;" * and in pursuance of this view the Comtean system limits itself to phenomena, and deliberately ignores the existence of anything implied by the phenomena. But though M. Comte thus exhibits to us a doctrine which, performing "the happy dispatch," eviscerates things and leaves a shell of appearances with no reality inside; yet I have in more than one place, and in the most emphatic way, declined thus to commit intellectual suicide. So far from regarding that which transcends phenomena as the "All-Nothingness," I regard it as the All-Being. Everywhere I have spoken of the Unknowable as the Ultimate Reality—the sole existence: all things present to consciousness being but shows of it. Mr. Harrison entirely inverts our relative positions. As I understand the case, the "All-Nothingness" is that phenomenal existence in which M. Comte and his disciples profess to dwell—profess, I say, because in their ordinary thoughts they recognize an existence transcending phenomena just as much as other people do.

That the opposition between the view actually held by me and the view ascribed to me by Mr. Harrison, is absolute, will be most clearly seen on observing the contrast he draws between my view and the view of the late Dean Mansel. He says:—

> Of all modern theologians, the Dean came the nearest to the evolution negation. But there is a gulf which separates even his all-negative deity from Mr. Spencer's impersonal, unconscious, unthinking, and unthinkable energy.

It is quite true that there exists this gulf. But then the propositions forming the two sides of the gulf are the opposites of those which Mr.

* "Système de Philosophie Positive," vol. i, pp. 5, 14.

Harrison represents. For whereas, in common with his teacher Sir William Hamilton, Dean Mansel alleged that our consciousness of the Absolute is merely "a negation of conceivability;" I have, over a space of ten pages,* contended that our consciousness of the Absolute is not negative but positive, and is the one indestructible element of consciousness "which persists at all times, under all circumstances, and can not cease until consciousness ceases"—have argued that while the Power which transcends phenomena can not be brought within the forms of our finite thought, yet that, as being a necessary datum of every thought, belief in its existence has, among our beliefs, the highest validity of any; is not, as Sir W. Hamilton alleges, a belief with which we are supernaturally "inspired," but is a normal deliverance of consciousness. Thus, as represented by Mr. Harrison, Dean Mansel's views and my own are exactly transposed. Misrepresentation could not, I think, go further.

The conception I have everywhere expressed and implied, of the relation between human life and the Ultimate Cause, if not diametrically opposed with like distinctness to the conception Mr. Harrison ascribes to me, is yet thus opposed in an unmistakable way. After suggesting that (x^x) would be an appropriate symbol "for the religion of the Infinite Unknowable," and amusing himself and his readers by imaginary prayers made to (x^x); after making a subsequent elaboration of his *jeu d'esprit* by suggesting that (nx) would serve for the formula of certain modern Theisms, he says of these:—

> The Neo-Theisms have all the same mortal weakness that the Unknowable has. They offer no kinship, sympathy, or relation whatever between worshiper and worshiped. They, too, are logical formulas begotten in controversy, dwelling apart from man and the world.

Now, considering that in the article he has before him there is in various ways implied the view that "the power which manifests itself in consciousness is but a differently conditioned form of the power which manifests itself beyond consciousness"—considering that here and everywhere throughout my books the implication is that our lives, alike physical and mental, in common with all the activities, organic and inorganic, amid which we live, are but the workings of this Power, it is not a little astonishing to find it described as simply a "logical formula begotten in controversy." Does Mr. Harrison really think that he represents the facts when he describes as "dwelling apart from man and the world," that Power of which man and the world are regarded products, and which is manifested through man and the world from instant to instant?

Did I not need the space for other topics, I might at much greater length contrast Mr. Harrison's erroneous versions with the true ones. I might enlarge on the fact that, though the name Agnosticism fitly

* "First Principles," § 26.

expresses the confessed inability to know or conceive the nature of the Power manifested through phenomena, it fails to indicate the confessed ability to recognize the existence of that Power as of all things the most certain. I might make clear the contrast between that Comtean Agnosticism which says that "Theology and ontology alike end in the Everlasting No with which science confronts all their assertions,"* and the Agnosticism set forth in "First Principles," which, along with its denials, emphatically utters an Everlasting Yes. And I might show in detail that Mr. Harrison is wrong in implying that Agnosticism, as I hold it, is anything more than silent with respect to the question of personality; since, though the attributes of personality, as we know it, can not be conceived by us as attributes of the Unknown Cause of things, yet "duty requires us neither to affirm nor deny personality," but "to submit ourselves with all humility to the established limits of our intelligence" in the conviction that the choice is not "between personality and something lower than personality," but "between personality and something higher,"† and that "the Ultimate Power is no more representable in terms of human consciousness than human consciousness is representable in terms of a plant's functions."‡

But without further evidence, what I have said sufficiently proves that Mr. Harrison's "criticism keen, trenchant, destructive," as it was called, is destructive, not of an actual doctrine, but simply of an imaginary one. I should hardly have expected that Mr. Harrison, in common with the "Edinburgh Reviewer," would have taken the course, so frequent with critics, of demolishing a simulacrum and walking off in triumph as though the reality had been demolished. Adopting his own figure, I may say that he has with ease passed his weapon through and through "The Ghost of Religion;" but then it is only the ghost: the reality stands unscathed.

Before passing to the consideration of that alternative doctrine which Mr. Harrison would have us accept, it will be well briefly to deal with certain of his subordinate propositions.

After re-stating in a succinct way, the hypothesis that from the conception of the ghost originated the conceptions of supernatural beings in general, including the highest, and after saying that "one can hardly suppose that Mr. Spencer would limit himself to that," Mr. Harrison describes what he alleges to be a prior, and, indeed, the primordial, form of religion. He says:—

> There were countless centuries of time, and there were, and there are, countless millions of men for whom no doctrine of superhuman spirits ever took coherent form. In all these ages and races, probably by far the most numerous that our planet has witnessed, there was religion in all kinds of definite form. Comte calls it fetichism—terms are not important: roughly, we may call it

* Harrison, *loc. cit.*, p. 497.

† "First Principles," § 31.

‡ "Essays," vol. iii, p. 251.

nature-worship. The religion in all these types was the belief and worship not of spirits of any kind, not of any immaterial, imagined being *inside* things, but of the actual visible things themselves—trees, stones, rivers, mountains, earth, fire, stars, sun, and sky. (P. 498.)

The attitude of discipleship is not favorable to inquiry; and, as fanatical Christians show us, inquiry is sometimes thought sinful and likely to bring punishment. I do not suppose that Mr. Harrison's reverence for M. Comte has gone this length; but still it has gone far enough not only to cause his continued adherence to a doctrine espoused by M. Comte which has been disproved, but also to make him tacitly assume that this doctrine is accepted by one whose rejection of it was long ago set forth. In the "Descriptive Sociology" there are classified and tabulated statements concerning some eighty peoples; and besides these I have had before me masses of facts, since collected, concerning many other peoples. An induction based on over a hundred examples, warrants me in saying that there has never existed anywhere such a religion as that which Mr. Harrison ascribes to "countless millions of men" during "countless centuries of time." A chapter on "Idol-worship and Fetich-worship" in the "Principles of Sociology," gives proof that in the absence of a developed ghost-theory, fetichism is absent. I have shown that, whereas among the lowest races, such as the Juángs, Andamanese, Fuegians, Australians, Tasmanians, and Bushmen, there is no fetichism; fetichism reaches its greatest height in considerably-advanced societies, like those of ancient Peru and modern India: in which last place, as Sir Alfred Lyall tells us, "not only does the husbandman pray to his plow, the fisher to his net, the weaver to his loom, but the scribe adores his pen, and the banker his account-books."* And I have remarked that, "had fetichism been conspicuous among the lowest races, and inconspicuous among the higher, the statement that it was primordial might have been held proved; but that as the facts happen to be exactly the opposite, the statement is conclusively disproved." †

Similarly with Nature-worship: regarding this as being partially distinguished from Fetichism by the relatively imposing character of its objects. In a subsequent chapter I have shown that this also, is an aberrant development of ghost-worship. Among all the many tribes and nations, remote in place and unlike in type, whose superstitions I have examined, I have found no case in which any great natural appearance or power, feared and propitiated, was not identified with a human or quasi-human personality. I am not aware that Professor Max Müller, or any adherent of his, has been able to produce a single case in which there exists worship of the great natural objects themselves, pure and simple — the heavens, the sun, the moon, the dawn, etc.: objects which, according to the mythologists, become

* "Religion of an Indian Province." † "Principles of Sociology," § 162.

personalized by "a disease of language." Personalization exists at the outset; and the worship is in all cases the worship of an indwelling ghost-derived being.

That these conclusions are necessitated by an exhaustive examination of the evidence, is shown by the fact that they have been forced on Dr. E. B. Tylor notwithstanding his original enunciation of other conclusions. In a lecture "On Traces of the Early Mental Condition of Man," delivered at the Royal Institution on the 15th of March, 1867, he said:—

> It is well known that the lower races of mankind account for the facts and events of the outer world by ascribing a sort of human life and personality to animals, and even to plants, rocks, streams, winds, the sun and stars, and so on through the phenomena of nature. . . . It would probably add to the clearness of our conception of the state of mind which thus sees in all nature the action of animated life and the presence of innumerable spiritual beings, if we gave it the name of Animism instead of Fetichism.

Here, having first noted that the conception of Fetichism derived by Dr. Tylor from multitudinous facts, is not like that of Mr. Harrison, who conceives Fetichism to be a worship of the objects themselves, and not a worship of their indwelling spirits, we further note that Dr. Tylor regards this ascription of souls to all objects, inanimate as well as animate, which he proposes to call Animism rather than Fetichism, as being primordial. In the earlier part of his "Primitive Culture," published in 1871, we find a re-statement of this view; but further on we observe a modification of it, as instance the following sentence in vol. ii, p. 100.

> It seems as though the conception of a human soul, when once attained to by man, served as a type or model on which he framed not only his ideas of other souls of lower grade, but also his ideas of spiritual beings in general, from the tiniest elf that sports in the long grass, up to the heavenly Creator and Ruler of the world, the Great Spirit.

And then, in articles published in "Mind" for April and for July, 1877, Dr. Tylor represented himself as holding a doctrine identical with that set forth by me in the "Principles of Sociology"; namely, that the belief in a human ghost is original, and that the beliefs in spirits inhabiting inanimate objects, giving rise to Fetichism and Nature-worship, are derived beliefs.

An emphatic negative is thus given to Mr. Harrison's assertion that "Nothing is more certain than that man everywhere started with a simple worship of natural objects." And if he holds that "the bearing of this on the future of religion is decisive"—if, as he says, "the religion of man in the vast cycles of primitive ages was reverence for nature as influencing Man," and if, as he infers, "the religion of man in the vast cycles that are to come will be the reverence for Humanity as supported by Nature"—if, as it thus seems, primitive religion as conceived by him is a basis for what he conceives to be the

religion of the future; then his conception of the religion of the future is, in so far, baseless.

And now I come to the chief purpose of this article—an examination of that alternative faith which Mr. Harrison has on sundry occasions set forth with so much eloquence. As originally designed, the essay, "Religion: a Retrospect and Prospect," was to include a section in which, before considering what the future of religion was likely to be, I proposed to consider what its future was *not* likely to be; and the topic to be dealt with in this section was the so-called Religion of Humanity. After collecting materials and writing ten pages, I began to perceive that, besides being not needful for my purpose, this section would form too large an excrescence. A further feeling came into play. Though I had for many years looked forward to the time when an examination of the Positivist creed would fall within the lines of my work, yet when I began to put on paper that which I had frequently thought, it seemed to me that I was making an uncalled-for attack on men whom I had every reason to admire for their high characters and their unwearying efforts for human welfare. The result was that I put aside what I had written, and gave up my long-cherished intention. Now, however, that Mr. Harrison has thrown down the gauntlet, I take it up, at once willingly and unwillingly—willingly in so far as acceptance of the challenge is concerned, unwillingly because I feel some reluctance in dealing hard blows at a personal friend.

Surprise has been the feeling habitually produced in me on observing the incongruity between the astounding claims made by the propounder of this new creed, and the great intelligence of disciples whose faith appears proof against the shock which these astounding claims produce on ordinary minds. Those who, from a broad view of human progress, have gained the general impression that "The individual withers, and the world is more and more," must be disinclined to believe that in the future any one individual will impose on the world a government like that sought to be imposed by M. Comte; who, unable to influence any considerable number of men while he lived, consoled himself with the thought of absolutely ruling all men after his death. Met, as he complained, by "a conspiracy of silence," he was nevertheless confident that, very shortly becoming converts, mankind at large would hereafter live and move and have their being within his elaborated formulas. Papal assumption is modest compared with the assumption of "the founder of the religion of Humanity." A single pope may canonize a saint or two; but M. Comte undertook the canonization of all those men recorded in history whom he thought specially worthy of worship. And such a canonization!—days assigned for the remembrance with honor of mythical personages like Hercules and Orpheus, and writers such as Terence and Juvenal; other days on which honors, like in degree, are given to Kant and to Robertson, to

Bernard de Palissy and to Schiller, to Copernicus and to Dollond, to Otway and to Racine, to Locke and to Fréret, to Froissart and to Dalton, to Cyrus and to Penn—such a canonization! in which these selected men who are the Positivist saints for ordinary days, are headed by greater saints for Sundays; with the result that Socrates and Godfrey are thus placed on a par; that while a day is dedicated to Kepler, a week is dedicated to Gall; Tasso has a week assigned to him, and Goethe a day; Mozart presides over a week, and a day is presided over by Beethoven; a week is made sacred to Louis the Eleventh, and a day to Washington—such a canonization! under which the greatest men, giving their names to months, are so selected that Frederic the Second and St. Paul alike bear this distinction; Gutemberg and Shakespeare head adjacent months; and while Bichat gives his name to a month, Newton gives his name to a week! This, which recalls the saints' calendar of the Babylonians, among whom, as Professor Sayce shows, "each day of the year had been assigned to its particular deity or patron saint," * exemplifies in but one way M. Comte's consuming passion for regulating posterity, and the colossal vanity which led him to believe that mankind would hereafter perform their daily actions as he dictated. He not only settles the hierarchy of saints who are above others to be worshiped, but he prescribes the forms of worship in minute detail. Nine sacraments are specified; prayer is to be made thrice a day; for the "daily expression of their emotions both in public and private" it is suggested that future men should use Italian; † and it is a recommended "rule of worship" of the person you adore, that "a precise idea of the place, next of the seat or the attitude, and, lastly, of the dress, appropriate to each particular case," ‡ should be summoned before the mind. Add to which that in the elaborate rubric the sacred sign (replacing the sign of the cross) and derived "from our cerebral theory" (he had a phrenology of his own) consists in placing "our hand in succession on the three chief organs—those of love, order, and progress." Of banners used in "solemn processions," it is directed that "on their white side will be the holy image; on their green, the sacred formula of Positivism;" and "the symbol of our Divinity will always be a woman of the age of thirty, with her son in her arms." * Nor was M. Comte's devouring desire to rule the future satisfied with thus elaborating the observances of his cult. He undertook to control the secular culture of men, as well as that culture which, I suppose, he distinguished as sacred. There is "a Positivist library for the nineteenth century," consisting of 150 volumes: the list being compiled for the purpose "of guiding the more thoughtful minds." ‖ So that M. Comte's tastes and judgments in poetry, science, history, etc., are to be the standards for future generations. And the numerous regulations of

* "Records of the Past," vol. vii, p. 157. † "System of Positive Polity," vol. iv, p. 85.
‡ "Catechism," p. 100. * "Catechism of Positivism," pp. 142, 143. ‖ Ibid., p. 38.

these kinds are in addition to the other multitudinous regulations contained in those parts of the highly elaborated "System of Positive Polity," in which M. Comte prescribes the social organization, under the arrangements of which "the affective, speculative, patrician, and plebeian" classes are to carry on the business of their lives.

It is, I say, not a little remarkable that a height of assumption exceeding that ever before displayed by a human being—a self-deification along with the deification of Humanity—should not have negatived belief in the general doctrines set forth by him. One might have thought that by exhibiting a lack of mental balance unparalleled among sane people, he would have wholly discredited his speculations. However, recognizing the fact that this is not so, and assuming that M. Comte's disciples discover in the Religion of Humanity propounded by him, a truth which survives recognition of his—eccentricities, let us call them—we will now go on to consider this proposed creed.

To those who have studied that natural genesis of religion summarized in the article Mr. Harrison criticises,* it will appear anomalous that a proposed new and higher religion should be, in large measure, a rehabilitation of the religion with which mankind commenced, and from which they have been insensibly diverging, until the more advanced among them have quite lost sight of it. After an era during which worship of the dead was practiced all the world over, alike by savages and by the progenitors of the civilized—after an era of slow emergence from this primitive religion, during which the propitiation of ghosts completely human was replaced by the propitiation of comparatively few superhuman ghosts or spirits, and finally by the propitiation of a spirit infinitely transcending humanity, and from which human attributes have been gradually dropped, leaving only the most abstract which are themselves fading; we are told by the Positivists that there is coming an era in which the Universal Power men have come to believe in, will be ignored; and human individualities, regarded now singly and now in their aggregate, will again be the objects of religious feeling. If the worship of the dead is not to be completely resuscitated, still the proposal is to resuscitate it in a form but partially transfigured. Though there is no direction to offer at graves food and drink for ghosts, yet public worship of the so-called "Great Being Humanity," "must be performed in the midst of the tombs of the more eminent dead, which tombs are surrounded by a sacred grove, the scene of the homage paid by their family and their fellow-citizens;" † while "at times within each consecrated tomb, the priesthood will" superintend the honoring of the good man or woman: ‡ proposed usages analogous to those of many ancestor-worshiping peoples. Moreover, again taking a lesson from various races of pagans,

* And set forth at length in "The Principles of Sociology," Part I.

† "Positive Polity," vol. iv, p. 139. ‡ "Catechism," p. 137.

past and present, there is to be "a domestic altar," at which, in kneeling attitude, adoration is to be paid to "our own personal patrons, our guardian angels, or household gods:" * these being persons living or dead. And as exemplified by M. Comte's worship of Clotilde de Vaux, the praying to a beloved person or wife may be continued for years; recalling the customs of multitudinous peoples who invoke departed members of their families, as instance the Balonda, among whom if the "spot where a favorite wife has died," . . . "is revisited, it is to pray to her." †

Now omitting for the present all thought about the worthiness of these objects of worship, and considering only the general nature of the system, there arises the question—How happens it that while in other respects M. Comte delineates human evolution as progressive, he, in this respect, delineates it as retrogressive? Beyond all question civilization has been a gradual divergence from primitive savagery. According to his own account, the advance in social organization, in knowledge, in science, in art, presents a certain general continuity. Even in speculative thought, M. Comte's formula of the three stages, the theological, the metaphysical, and the positive, tacitly asserts movements in the same direction toward a final theory. How happens it, then, that with an advancing change in other things, there is to occur a retreating change in one thing?—along with progression in all else, retrogression in religion?

This retrogressive character of the Comtean religion is shown in sundry other ways—being, indeed, sometimes distinctly admitted or avowed. Thus we are told that "the domain of the priesthood must be reconstituted in its integrity; medicine must again become a part of it," ‡ as from savage life upward it was until modern times. Again, education has been slowly emancipating itself from ecclesiasticism; but in M. Comte's scheme, after the sacrament of initiation, the child passes "from its unsystematic training under the eye of its mother to the systematic education given by the priesthood;" # just as, after a parallel ceremony, the child does among the Congo people,‖ and as it did among the ancient Mexicans.^ And knowingly or unknowingly, M. Comte followed the lead of the Egyptians who had a formal judging of the dead by the living: honorable burial was allowed by them only in the absence of accusations against the deceased proved before judges; and by M. Comte it is provided that after a prescribed interval, the priesthood shall decide whether the remains shall be transferred from their probationary resting-place to "the sacred wood" reserved for the "sanctified." Most remarkable of all, however, is the reversion to an early type of religious belief

* "Positive Polity," vol. iv, pp. 100, 101.
† Livingstone, "South Africa," p. 314.
‡ "Catechism," p. 50.
# "Catechism," p. 129.
‖ Bastian (A.), "Africanische Reisen," p. 85.
^ Torquemada (Juan de), "Monarquia Indiana," book ix, chaps. xi to xiii.

in the prescribed worship of objects, animate and inanimate. In "Table A, System of Sociolatry," there are times named for the "Festival of the Animals," "Festival of Fire," "Festival of the Sun," "Festival of Iron," etc.

But now, passing over M. Comte's eccentricities and inconsistencies, let us consider on its merits the creed he enunciated. In addition to private worship of guardian angels or household gods, there is to be a public worship of the "Great Being Humanity." How are we to conceive this Great Being? Various conceptions of it are possible; and more or less unlike conceptions are at one time or other presented to us. Let us look at them in succession.

By M. Comte himself, at page 74 of the "Catechism of Positive Religion," we are told that we must—

> define Humanity as the whole of human beings, past, present, and future. The word *whole* points out clearly that you must not take in all men, but those only who are really capable of assimilation, in virtue of a real co-operation on their part in furthering the common good.

On which the first comment suggesting itself is that the word "*whole* points out clearly" not limitation, but absence of limitation. Passing over this, however, and agreeing to exclude, as is intended, criminals, paupers, beggars, and all who "remain in the parasitic state," it seems that we are to include in the aggregate object of our worship, all who have aided, now aid, and will hereafter aid, social growth and development. Though elsewhere* it is limited to those who "co-operate willingly," yet since "the animals which voluntarily aid man" are recognized as "integral portions of the Great Being," and since the co-operation of slaves is as "voluntary" as that of horses, we seem compelled to include, not the superior men and classes only, but even those who, under a coercion such as is used to domestic animals, have helped to subdue the Earth and further the material progress of Humanity. And since the progress of Humanity has been largely aided by the spread of the higher races and accompanying extermination of the lower races, we must comprehend in our conception of this worshipful Great Being all those who, from the earliest savage times, have, as leading warriors and common soldiers, helped by their victories to replace inferior societies by superior ones; not only bloodthirsty conquerors like Sesostris (who is duly sanctified in the calendar) but even such cannibals as the Aztecs, who laid the basis of the Mexican civilization.

So far from seeing in the "Great Being Humanity," as thus defined, anything worshipful, it seems to me that contemplation of it is calculated to excite feelings which it is best to keep out of consciousness.

But now, not to take the doctrine at a disadvantage, let us conceive the object of the Positivist's adoration under a better aspect.

* "Catechism," p. 427.

Let us consider what claims to godhood may be made for the Humanity immediately known to us. Unquestionably M. Comte's own doctrine, that there has been going on an evolution of mankind, implies that such portion of the "Great Being Humanity" as is formed by our own generation, is better than the average of those portions which have heretofore lived and died. What then shall we say of this better portion?

Of course we must keep out of thought all the bad conduct going on around—the prevailing dishonesty shown in adulteration by retailers and production of debased goods by manufacturers, the inefficient and dawdling work of artisans, the many fraudulent transactions of which a few are daily disclosed at trials; though why we are to exclude the blameworthy from our conception of Humanity, I do not understand. But not dwelling on this, let us contemplate first the intellectual traits, and then the moral traits, of the people who remain after leaving out the worse.

Those whose mental appetites are daily satisfied by table talk almost wholly personal, by gossiping books and novels, and by newspapers the contents of which are usually enjoyed the more in proportion as there is in them much of the scandalous or the horrible—those who, on Sunday, never working out their own beliefs, receive the weekly dole of thought called for by their state of spiritual pauperism—those who, to the ideas they received during education, add only such as are supplied by daily journals and weekly sermons, with now and then a few from books, having none of their own worth speaking of; we may be content to class as respectable in the conventional sense, though scarcely in any higher sense—still less to include them as chief components in a body exciting reverence. Even if we limit attention to those of highest culture, including all who are concerned in regulative functions, political, ecclesiastical, educational, or other, the displays of intelligence do not call forth such an emotion as that which M. Comte's theory requires us to entertain. What shall we say of the wisdom of those, including nearly all who occupy influential positions, who persist in thinking that preparation for successful and complete living (which is the purpose of rational education) is best effected by learning to speak and write after the manner of two extinct peoples, and by gaining knowledge of their chief men, their superstitions, their deeds of war, etc.—who, in their leading school, devote two hours per week to getting some ideas about the constitution of the world they are born into, and thirty-six hours per week to construing Latin and Greek and making verses, nonsensical or other; and who, in the competitive examinations they devise, give to knowledge of words double the number of marks which they give to knowledge of things? That, it seems to me, is not a very worshipful degree of intelligence which fails to recognize the obvious truth that there is an Order of Nature, pervading alike the actions going on within us

and without us, to which, from moment to moment, our lives must conform under penalty of one or other evil; and that therefore our first business must be to study this Order of Nature. Nor is estimation of this intelligence raised on contemplating the outcome of this established culture, as seen in Parliament; where any proposal to judge a question by reference to general laws, or "abstract principles" as they are called, is pooh-poohed, with the tacit implication that in social affairs there is no natural law; and where, as we lately saw, 300 select spokesmen of the nation cheered frantically when it was decided that they should continue to vow before God that they would maintain certain arrangements prescribed for them by their great, great, great, etc. grandfathers.

On turning to the moral manifestations, we find still less that is calculated to excite the required religious feeling. When multitudes of citizens belonging to the classes distinguished as "the better," make a hero of a politician whose sole aim throughout life was success, regardless of principle, and have even established an annual commemoration of him, we are obliged to infer that the prevailing sentiments are not of a very high order. Nothing approaching to adoration is called forth by those who, on the death of a youth who went to help in killing Zulus, with whom he had no quarrel, and all that he might increase his chance of playing despot over the French, thought him worthy of high funeral honors—would, many of them, indeed, have given him the highest. No feeling of reverence arises in one's mind on thinking of people who looked on with approval or tolerance when a sailor of fortune, who has hired himself out to an eastern tyrant to slay at the word of command, was honored here by a banquet. A public opinion which recognizes no criminality in wholesale homicide so long as it is committed by a constituted political authority, no matter how vile, or by its foreign hired agent who is indifferent to the right or wrong of the question at issue, is a public opinion which excites, in some at any rate, an emotion nearer to contempt than to adoration.

This emotion is not changed on looking abroad and contemplating the implied natures of those who guide, and the implied natures of those who accept the guidance. When, among a people professing that religion of peace preached to them generation after generation by tens of thousands of priests, an assembly receives with enthusiasm, as lately at the Gambetta dinner, the toast, "The French army, the highest embodiment of the French nation"—when, along with nominal acceptance of forgiveness as a Christian duty, there goes intense determination to retaliate; we are obliged to reprobate either the feeling which they actually think proper, or the hypocrisy with which they profess that the opposite feeling is proper. On finding in another advanced society that the seats of highest culture are seats of discipline in barbarism, where the test of man-

hood is the giving and taking of wounds in fights arising from trivial causes or none at all, and where, last year, a single day witnessed twenty-one such encounters in one university; we are reminded more of North American Indians, among whom tortures constitute the initiation of young men, than of civilized people taught for a thousand years to do good even to enemies. Or when we see, as lately in a nation akin to the last, that an officer who declined to break at once the law of his country and the law of his religion by fighting a duel, was expelled the army; we are obliged to admit that profession of a creed which forbids revenge, by those whose deeds emphatically assert revenge to be a duty (almost as emphatically as do the lowest races of men), presents Humanity under an aspect not at all of the kind which we look for in "the adorable Great Being." Not reverence, not admiration, scarcely even respect, is caused by the sight of a hundred million Pagans masquerading as Christians.

I am told that by certain of M. Comte's disciples (though not by those Mr. Harrison represents) prayer is addressed to "holy" Humanity. Had I to choose an epithet, I think "holy" is about the last which would occur to me.

"But it is only the select human beings—those more especially who are sanctified in the Comtist calendar—who are to form the object of worship; and, for the worship of such, there is the reason that they are the benefactors to whom we owe everything."

On the first of these statements, made by some adherents of M. Comte, one remark must be that it is at variance with M. Comte's own definition of the object of worship, as quoted above; and another remark must be that, admitting such select persons to be worshipful (and I do not admit it), there is no more reason for worshiping Humanity as a whole on the strength of these best samples, than there is for worshiping an ordinary individual, or even a criminal, on the strength of the few good actions which qualified the multitudinous indifferent actions and bad actions he committed. The second of these statements, that Humanity, either as the whole defined by M. Comte or as represented by these select persons, must be adored as being the producer of everything which civilization has brought us, and, in a measure, even the creator of our higher powers of thought and action, we will now consider. Let us hear M. Comte himself on this point:

Thus each step of sound training in positive thought awakens perpetual feelings of veneration and gratitude; which rise often into enthusiastic admiration of the Great Being, who is the author of all these conquests, be they in thought, or be they in action.*

What may have been the conceptions of "veneration and gratitude" entertained by M. Comte, we can not, of course, say; but if

* "System of Positive Polity," vol. ii, p. 45.

any one not a disciple will examine his consciousness, he will, I think, quickly perceive that veneration or gratitude felt toward any being, implies belief in the conscious action of that being—implies ascription of a prompting motive of a high kind, and deeds resulting from it: gratitude can not be entertained toward something which is unconscious. So that the "Great Being Humanity" must be conceived as having in its incorporated form, ideas, feelings, and volitions. Naturally there follows the inquiry—"Where is its seat of consciousness?" Is it diffused throughout mankind at large? That can not be; for consciousness is an organized combination of mental states, implying instantaneous communications such as certainly do not exist throughout Humanity. Where, then, must be its center of consciousness? In France, of course, which, in the Comtean system, is to be the leading State; and naturally in Paris, to which all the major axes of the temples of Humanity are to point. Any one with adequate humor might raise amusing questions respecting the constitution of that consciousness of the Great Being supposed to be thus localized. But, preserving our gravity, we have simply to recognize the obvious truth that Humanity has no corporate consciousness whatever. Consciousness, known to each as existing in himself, is ascribed by him to other beings like himself, and, in a measure, to inferior beings; and there is not the slightest reason for supposing that there ever was, is now, or ever will be, any consciousness among men save that which exists in them individually. If, then, "the Great Being, who is the Author of all these conquests," is unconscious, the emotions of veneration and gratitude are absolutely irrelevant.

It will doubtless seem a paradox to say that human evolution with all its marvels, is to be credited neither to Humanity as an aggregate, nor to its component individuals; but the paradox will not be difficult to justify: especially if we set out with some analogies. An apt one is supplied by that "thing of beauty," the *Euplectella* or "Venus' flower-basket," now not uncommon as a drawing-room ornament. This fragile piece of animal architecture is not a product of any conscious creature, or of any combination of conscious creatures. It is the framework unknowingly elaborated by innumerable ciliated monads—each a simple nucleated cell, with a whip-like appendage which serves, by its waving movements, to aid the drawing in and sending out of sea-water, from which nutritive matter is obtained; and it is simply by the proclivities which these monads have toward certain modes of growth and secretion, that they form, without the consciousness of any one, or of all, this complicated city they inhabit. Again, take the case of a coral island. By it we are shown that a multitude of insignificant individuals may, by their separate actions carried on without concert, generate a structure imposing by its size and stability. One of these palm-covered atolls standing up out of vast depths in the Pacific, has been slowly built up by coral-polyps, while, through

successive small stages, the ocean-bottom has subsided. The mass produced by these brainless and almost nerveless animals—each by its tentacles slowly drawing in such food as the water occasionally brings, and at intervals budding out, plant-like, a new individual—is a mass exceeding in vastness any built by men, and defies the waves in a way which their best breakwaters fail to do: the whole structure being entirely undesigned, and, indeed, absolutely unknown to its producers, individually or in their aggregate.

Prepared by these analogies, every one will see what is meant by the paradox that civilization, whether contemplated in its great organized societies or in their material and mental products, can be credited neither to any ideal "Great Being Humanity," nor to the real beings summed up under that abstract name. Though we can not in this case say that neither the aggregate nor its units have had any consciousness of the results wrought out, yet we may say that only after considerable advances of civilization, has this consciousness existed on the part of a few. Communities have grown and organized themselves through the attainment of private ends, mostly pursued with entire selfishness, and in utter ignorance of any social effects produced. If we begin with those early stages in which, among hostile tribes, one more numerous or better led than the rest, conquers them, and, consolidating them into a larger society, at the same time stops inter-tribal wars; we are shown that this step in advance is made, not only without thought of any advantage to Humanity, but often under the promptings of the basest motives in the mind of the most atrocious savage. And so onward. It needs but to glance at such wall-paintings as those of the conquering Rameses at Karnac, or to read the inscriptions in which Assyrian kings proudly narrated their great deeds, to see that personal ambitions were pursued with absolute disregard of human welfare. But for that admiration of military glory with which classical culture imbues each rising generation, it would be felt that whatever benefits these kings unknowingly wrought, their self-praising records have brought them not much more honor than has been brought to the Fijian king Tanoa by the row of nine hundred stones recording the number of victims he devoured. And though the outcome of those struggles for supremacy in which, during European history, so many millions have been sacrificed, has been the formation of great nations fitted for the highest types of structure; yet when, hereafter, opinion is no longer swayed by public-school ethics, it will be seen that the men who effected these unions did so from desires which should class them with criminals rather than with the benefactors of mankind. With governmental organizations it was the same as with social consolidations: they arose not to secure the blessings of order, but to maintain the ruler's power. As the original motive for preventing quarrels among soldiers was that the army might not be rendered inefficient before the enemy, so, throughout the militant society at large, the motive for

suppressing conflicts was partly that of preventing hindrance to the king's wars, and partly that of asserting his authority. Administration of justice, as we know it, grew up incidentally; and began with bribing the ruling man to interfere on behalf of the complainant. Not wishes for the public weal, but wishes for private profit and power, originated the regulative organizations of societies. So has it been, too, with their industrial organizations. Acts of barter between primitive men were not prompted by thoughts of benefits to Humanity, to be eventually achieved by division of labor. When, as among various peoples, on occasions of assembling to make sacrifices at sacred places, some of the devotees took with them commodities likely to be wanted by others who would be there, and from whom needful supplies could be got in exchange, they never dreamed that they were making the first steps toward establishment of fairs, and eventually of markets: purely selfish desires prompted them. Nor on the part of the peddlers who, supplying themselves wholesale at these gatherings, traveled about selling retail, was there any beneficent intention of initiating that vast and elaborate distributing system which now exists. Neither they nor any men of their time had imagined such a system. And the like holds of improved arts, of inventions, and, in large measure, of discoveries. It was not philanthropy which prompted the clearing of wild lands for the purpose of growing food; it was not philanthropy which little by little improved the breeds of animals, and adapted them to human use; it was not philanthropy which in the course of time changed the primitive plow into the finished modern plow. Wishes for private satisfactions were the exclusive stimuli. The successive patents taken out by Watt, and his lawsuits in defense of them, show that though he doubtless foresaw some of the benefits which the steam-engine would confer on mankind, yet foresight of these was not the prime mover of his acts. The long concealment of the method of fluxions by Newton, as well as the Newton-Leibnitz controversy which subsequently arose, show us that while there was perception of the benefits to science, and indirectly to Humanity, from the discoveries made by these mathematicians, yet that desires to confer these benefits were secondary to other desires—largely the love of scientific exploration itself, and, in a considerable degree, "the last infirmity of noble minds." Nor has it been otherwise with literature. Entirely dissenting, though I do, from the dictum of Johnson, that "No man but a blockhead ever wrote except for money," and knowing perfectly well that many books have been written by others than "blockheads," not only without expectation of profit, but with the certainty of loss; yet I hold it clear that the majority of authors do not differ from other men to the extent that the desire to confer public benefit predominates over the desire to reap private benefit; in the shape of satisfied ambition if not in the shape of pecuniary return. And it is the same with the delights given to mankind by artis-

tic products. The mind of the artist, whether composer, painter, or sculptor, has always been in a much greater degree occupied by the pleasure of creation, and the thoughts of reward, material or mental, than by the wish to add to men's gratifications.

But we are most clearly shown how little either any aims of an ideal "Great Being," or any philanthropic aims of individuals, have had to do with civilization, by an instance which M. Comte himself refers to as proving our indebtedness. He says: "Language alone might suffice to recall to the mind of every one how completely every creation of man, is the result of a vast combination of efforts, equally extended over time and space."* Now nothing is more manifest than that language has been produced neither by the conscious efforts of the imagined "Great Being, who is the Author of all these conquests," nor by the conscious efforts of individual men. Passing over that intentional coining of words which occurs during the later stages of linguistic progress, it is undeniable that during those earlier stages which gave to languages their essential structures and vocabularies, the evolutionary process went on without the intention of those who were instrumental to it. The man who first, when discussing a probability, said *give* (i. e. grant, or admit), so-and-so, and such and such follows, had no idea that by his metaphorical *give* (which became *gif* and then *if*) he was helping to initiate a grammatical form. The original application of the word *orange* to some object like an orange in color, was made without consciousness that the act would presently lead to enrichment of the language by an additional adjective. And so throughout. The minute additions and modifications which have, in thousands of years, given to human speech its present perfection, arose as random changes without thought of improvement; and the good ones insensibly spread as serving better the purposes of those who adopted them.

Thus, accepting M. Comte's typical instance of the obligations under which Humanity during the past has placed individuals at present, we must say that language, having been evolved during men's intercourse without the least design on their parts of conferring benefits, and without the faintest consciousness of what they were doing, affords no reason whatever for regarding them with that "veneration and gratitude" which he thinks due.

"But surely 'veneration and gratitude' are due somewhere. Surely civilized society, with its complex arrangements and involved processes, its multitudinous material products and almost magical instruments, its language, science, literature, art, must be credited to some agency or other. If the 'Great Being, Humanity,' considered as a whole, has not created it for us—if the individuals who have co-operated in producing it have done so while pursuing their private ends,

* "Positive Polity," vol. ii, p. 48.

mostly without consciousness that they were either furthering or hindering human progress, how happens it that such benefits have been achieved, and to what shall we attribute achievement of them?"

To Mr. Harrison, if his allegiance to his master is unqualified, no answer which he will think satisfactory can be given; for M. Comte negatives the recognition of any cause for the existence of human beings and the "Great Being" composed of them. It was one of his strange inconsistencies that, though he held it legitimate to inquire into the evolution of the Solar System (as is shown by his acceptance of the nebular hypothesis), and though he treats of human society as a product of evolution, yet all that region lying between the formation of planets and the origin of primitive man, was interdicted by him. To those, however, who accept the doctrine of organic evolution, either with or without the doctrine of evolution at large, the obvious answer to the above question will be that if "veneration and gratitude" are due at all, they are due to that Ultimate Cause from which Humanity, individually and as a whole, in common with all other things, has proceeded. There is nothing in embodied Humanity but what results from the properties of its units—properties mainly prehistoric, and in a small measure generated by social life. If we ask whence come these properties—these structures and functions, bodily and mental—we must go for our answer to the slow operation of those processes of modification and complication through which, with the aid of surrounding conditions, ever themselves growing more involved, there have been produced the multitudinous organic types, up to the highest. If we persist in putting question beyond question, we are carried back to those more general causes which determined the structure and composition of the Earth during its concentration; and eventually we are carried back to the nebulous mass in which there existed, undistinguished into those concrete forms we now know, the forces out of which all things contained in the Solar System have come, and in which there must have been, as Professor Tyndall expresses it, "the promise and potency of all terrestrial life." Whether we contemplate such external changes as those of stars moving ten miles per second, and those which now in hours, now in years, now in centuries, arrange molecules into a crystal; or whether we contemplate internal changes, arising in us as ideas and feelings, and arising also in the chick which but a few weeks since was a viscid yelk, we are compelled to recognize everywhere an Energy capable of all forms and which has been ever assuming new forms, from the remotest time to which science carries us back down to the passing moment. If we take the highest product of evolution, civilized human society, and ask to what agency all its marvels must be credited, the inevitable answer is—To that Unknown Cause of which the entire Cosmos is a manifestation.

A spectator who, seeing a bubble floating on a great river, had his attention so absorbed by the bubble that he ignored the river—nay,

even ridiculed any one who thought that the river out of which the bubble arose and into which it would presently elapse, deserved recognition, would fitly typify a disciple of M. Comte, who, centering all his higher sentiments on Humanity, holds it absurd to let either thought or feeling be occupied with that great stream of Creative Power, unlimited in Space or in Time, of which Humanity is a transitory product. Even if, instead of being the dull leaden-hued thing it is, the bubble Humanity had reached that stage of iridescence of which, happily, a high sample of man or woman sometimes shows us a beginning, it would still owe whatever there was in it of beauty to that Infinite and Eternal Energy out of which Humanity has quite recently emerged, and into which it must, in course of time, subside. As with thousands of lower types of creatures which have severally illustrated the truth that the life and death of the individual prefigure in brief space the life and death of the race, so with this highest type of creature, Man: a beginning and end to Humanity are no less certain than the beginning and end to each human being. And to suppose that this relatively-evanescent form of existence ought to occupy our minds so exclusively as to leave no space for a consciousness of that Ultimate Existence of which it is but one form out of multitudes —an Ultimate Existence which was manifested in infinitely-varied ways before Humanity arose, and will be manifested in infinitely-varied other ways when Humanity has ceased to be, seems very strange —to me, indeed, amazing.

And here this contrast between the positivist view and my own view, equally marked now as it was at first, leads me to ask in what respects the criticisms passed on the article—"Religion: a Retrospect and Prospect" have affected its argument. Many years ago, as also by implication in that article, I contended that while Science shows that we can know phenomena only, its arguments involve no denial of an Existence beyond phenomena. In common with leading scientific men whose opinions are known to me, I hold that it does not bring us to an ultimate negation, as the presentations of my view made by Mr. Harrison and Sir James Stephen imply; and they have done nothing to show that its outcome is negative. Contrariwise, the thesis many years ago maintained by me against thinkers classed as orthodox,* and reasserted after this long interval, is that though the nature of the Reality transcending appearances can not be known, yet that its existence is necessarily implied by all we do know—that though no conception of this Reality can be framed by us, yet that an indestructible consciousness of it is the very basis of our intelligence;† and I do not find, either in Mr. Harrison's criticisms or in those of Sir James Stephen, any endeavor to prove the untruth of this thesis. More-

* "First Principles," § 26.

† Sir James Stephen, who appears perplexed by the distinction between a conception and a consciousness, will find an explanation of it in "First Principles," § 26.

over, as originally elaborated and as recently restated, my argument was that in the discovery by Science that it could not do more than ascertain the order among phenomena, there was involved a tacit confession of impotence in presence of the Mystery of Things—a confession which brought Science into sympathy with Religion; and that in their joint recognition of an Unknowable Cause for all the effects constituting the knowable world, Religion and Science would reach a truth common to the two. I do not see that anything said by my critics has shaken this position. I held at the outset, and continue to hold, that this Inscrutable Existence which Science, in the last resort, is compelled to recognize as unreached by its deepest analyses of matter, motion, thought, and feeling, stands toward our general conception of things, in substantially the same relation as does the Creative Power asserted by Theology; and that when Theology, which has already dropped many of the anthropomorphic traits ascribed, eventually drops the last of them, the foundation-beliefs of the two must become identical. So far as I see, no endeavor has been made to show that this is not the case. Further I have contended, originally and in the article named, that this Reality transcending appearance (which is not simply unknown as Mr. Harrison thinks it should be called, but is proved by analysis of the form of our intelligence to be unknowable), * standing toward the Universe and toward ourselves in the same relation as an anthropomorphic Creator was supposed to stand, bears a like relation with it not only to human thought but to human feeling: the gradual replacement of a Power allied to humanity in certain traits, by a Power which we can not say is thus allied, leaves unchanged certain of the sentiments comprehended under the name religious. Though I have argued that in ascribing to the Unknowable Cause of things such human attributes as emotion, will, and intelligence, we are using words which, when thus applied, have no corresponding ideas; yet I have also argued that we are just as much debarred from denying as we are from affirming such attributes; † since, as ultimate analysis brings us everywhere to alternative impossibilities of thought, we are shown that beyond the phenomenal order of things, our ideas of possible and impossible are irrelevant. Nothing has been said which requires me to change this view: neither Mr. Harrison's statement that "to make a religion out of the Unknowable is far more extravagant than to make it out of the Equator," nor Sir James Stephen's description of the Unknowable as "like a gigantic soap-bubble not burst but blown thinner and thinner till it has become absolutely imperceptible," seems to me applicable. One who says that because the Infinite and Eternal Energy from which all things proceed, can not in any way be brought within the limits of human consciousness it therefore approaches to a nonentity, seems to me like one who says of a vast number that because it passes all possibility of

* "First Principles," Part I, chapter iv. † "First Principles," § 31.

enumeration it is like nothing, which is also innumerable. Once more when implying that the Infinite and Eternal Energy manifested alike within us and without us, and to which we must ascribe not only the manifestations themselves but the law of their order, will hereafter continue to be, under its transfigured form, an object of religious sentiment; I have implied that whatever components of this sentiment disappear, there must ever survive those which are appropriate to the consciousness of a Mystery that can not be fathomed and a Power that is omnipresent. Mr. Harrison and Sir James Stephen have said nothing to invalidate this position. Lastly, let me point out that I am not concerned to show what effect religious sentiment, as hereafter thus modified, will have as a moral agent; though Mr. Harrison, by ridiculing the supposition that it will make good men and women, seems to imply that I have argued, or am bound to argue, that it will do this. If he will refer to the "Data of Ethics" and other books of mine, he will find that modification of human nature, past and future, I ascribe in the main to the continuous operation of surrounding social conditions and entailed habits of life; though past forms of the religious consciousness have exercised, and future forms will I believe exercise, co-operative influences.*

How, then, does the case stand? Under "Retrospect," I aimed to show how the religious consciousness arose; and under "Prospect" what *of this consciousness* must remain when criticism has done its utmost. My opponents would have succeeded had they shown (1) that it did not arise as alleged; or (2) that some other consciousness would remain; or (3) that no consciousness would remain. They have done none of these things. Looking at the general results, it seems to me that while the things I have said have not been disproved, the things which have been disproved are things I have not said.

SOME RAMBLES OF A NATURALIST.†

By CHARLES C. ABBOTT, M. D.

WHEN I happen out for a stroll, the difficulty that besets me is not what to seek—for to ramble without an object is an abomination—but what to choose of the endless variety of objects worthy of attention. I do not like to determine this after I have started, but prefer saying to myself, "I will watch the birds to-day," or, "I will hunt up the meadow-mice." To do this at once gives an additional interest to a contemplated ramble; and, in all my experience, I have

* "Data of Ethics," § 62.

† From the author's "Rambles about Home," in the press of D. Appleton & Co.

never yet failed to find some trace, at least, of that object to observe which I took the walk.

Whenever I have seen a mink in my meadow-rambles, I have been impressed with the fact that all animals that fear man are as much on the lookout for him, and try as sedulously to avoid him, as they do any of their natural enemies. If they do so, is it at all strange that we so seldom see them when we go bungling about their haunts? We probably never take a walk in the woods that we are not watched by many creatures which we do not see; and many a squeak or whistle which, if heard at all, is attributed to some bird, is a signal-cry of danger made by some one animal which, having seen us, takes this method of warning its fellows. I have more than once tested this in the case of the mink. Mooring my boat near where I had reason to believe these animals had their nests, and remaining perfectly quiet and in hiding, I have usually been rewarded by seeing the minks moving about as soon as their confidence was restored by the absence of all signs of life in or about the boat. They would come out of their burrows, or from under large roots, and dive into the water, or it might be that they carried a mussel from the shore to their retreat.

Any act of this kind, free from the restraint of fear, is in the case of all animals the most interesting and instructive, and, were our opportunities of this kind more frequent, our knowledge of animal life would soon be largely increased.

During the spring and summer of 1874 especially, and at all favorable opportunities since, my out-door studies were largely confined to particular phases of bird-life, rather than to their habits generally. Most prominent among these was that of singing, and its relation to the other utterances of birds, for I had been long under the impression, and since am fully convinced, that a bird's song bears just the same relationship to its various chirps, twitters, and calls, that singing with mankind bears to ordinary conversation. Careful observation will enable any one to see clearly that every bird has a considerable range of utterance. Observe two birds immediately after mating, and what a laughable caricature of a newly-married couple—say on their wedding-journey—are their actions and their low, ceaseless twittering! They also have their petty vexations and their little quarrels, in which the feminine voice is ever the louder and more rapid in its utterance, and its owner enjoys the precious privilege of the last word.

But it may be urged that to constitute language, or something akin to it, these chirps and twitters must be shown to convey ideas. Can one bird tell another anything? it will be asked. To this I answer that, if any one has watched a colony of brooding krakles, or paid close attention to a flock of crows, he has probably satisfied himself upon this point. Crows have twenty-seven distinct cries, calls, or utterances, each readily distinguishable from the other, and each having an unmistakable connection with a certain class of actions; some of which,

as, for instance, the many different notes of the brooding-birds, are only heard at certain seasons. In this connection, it may be added that the intelligence of crows is fully one half greater than that of any other bird in our fauna. Instances of the exercise of much cunning and forethought on their part are almost innumerable.

Let us see, however, if among our singing-birds there is not to be found evidence of an ability to communicate ideas, presumably by the aid of vocal sounds. Here is an occurrence that took place in my presence in the spring of 1872. A pair of cat-birds were noticed carrying materials for a nest to a patch of blackberry-briers hard by. To test their ingenuity, I took a long, narrow strip of muslin, too long for one bird to carry conveniently, and placed it on the ground in a position to be seen by the birds when searching for suitable materials for their nests. In a few moments one of the cat-birds spied the strip and endeavored to carry it off, but its length and weight, in whichever way the bird took hold of it, and he tried many, impeded its flight. After worrying over it for some time the bird flew off, not, as I supposed, to seek other materials, but, as it proved, to obtain assistance in transporting the strip of muslin in question. In a few moments it returned with its mate, and then, standing near the strip, they held what I consider to have been a consultation. The chirping, twittering, murmuring, and occasional ejaculations were all unmistakable. In a few moments this chattering, if you will, ceased, and the work commenced. Each took hold of the strip of muslin at about the same distance from the ends, and, starting exactly together, they flew toward their unfinished nest, bearing the prize successfully away.

I followed them as quickly as possible, and, reaching the brier-patch, never before or since heard such an interminable wrangling and jabbering. Had I not seen the birds, I doubt if I should have recognized them from their voices. The poor birds simply could not agree how to use so long a piece of material to the best advantage. If it had been shorter, they might have made it serviceable ; but as it was, being neither willing to discard it nor able to agree as to its proper use, they finally abandoned it altogether, and so too they did the unfinished nest and the neighborhood.

In one corner of a low-lying tract near my house, called the " mucky meadow," there remains a clump of large maples, pin-oaks, and birches which have somehow been spared by the former owners of the land. They are mine now and are safe. At the first white frost, the hollow maple, that throughout the summer has securely housed a family of short-eared owls, now gives us evidence of the fact, by dropping the leafy screen that hid them well from view. While the young were yet babies the old tree shielded them well—now they are able to shift for themselves, and the tree offers them shelter, but nothing more. With the departure of the sunlight the owls are all astir, and it is funny enough to see them. Of a single owl but little can be said ; but before the

family separates, and while the young are receiving their lessons in mouse-hunting, it becomes very evident, first, that owls are great talkers; and, secondly, that they are decidedly intelligent. I was impressed with these facts during a pleasant moonlight evening last October, when, having taken my stand to watch the owls, I saw the whole family of six as they came from their nest in the tree. The old birds first appeared, flew directly toward the meadow, and disappeared in the long grass. Soon the four young birds made their appearance, but only to creep cautiously along the limbs of the tree, and then settle themselves, in a lazy, muffled-up manner, as though nothing remained to be done. All the while the old birds kept up a peculiar call—more like a scream than a hoot—not altogether unpleasant to the ear. I am in doubt whether the young owls made any reply, though I took a faint clicking noise to be such. In a little while, however, they began to get hungry, and then they uttered unmistakable cries, to which the parent owls replied by returning to the tree. In the beak of each owl was a mouse, or what I took to be such, and when they alighted on the maple I could detect, in the uncertain light, that they did not approach closely to the young birds, but, having removed the mice, which they now held in their claws, they chattered and screamed to their young, in a manner that could only be interpreted as, "Come over here and get your mouse." It was evident that the young owls were to be taught to help themselves, and to practice their power of flight. As an inducement to do the latter, the mice were held temptingly before them, but quite out of reach. Finally, one young owl, more venturesome than his fellows, essayed to fly; but it was a miserable failure, for, instead of reaching the desired branch, it fell short a foot or more, and tumbled to the ground. I can not prove that owls laugh, but I think any one who heard the old birds just then would never doubt the fact that they do. The funniest feature, however, was that the three remaining young birds were disgusted with what they saw, or were frightened by it—at all events, they hastened back to the nest, and I saw them no more that evening.

Of the poor fellow that fell to the ground there is much to be said, as it was with it that the old birds were now wholly concerned, and their actions were highly entertaining. Leaving the tree, they flew down to the hapless bird, and muttered in low tones to it, in a most sympathizing manner. Their utterances now, which I could hear notwithstanding the racket made by the frogs, were very varied, and gave the impression that they were holding a conversation. After the lapse of a minute or more the old birds together took a short, low flight, and then returned to the young owl. Was it not to show it how easy flight was? Then again they flew away, in the same manner, and the young owl endeavored to follow. It was with evident difficulty that it left the ground, but when once its feet were clear of the

grass it progressed satisfactorily, though only for a short distance. This pleased the old birds, for one of them came to the plucky little fellow, and, with one wing extended, patted the young bird on the head and back most tenderly. At this I laughed aloud, most unfortunately, and immediately the old birds flew to the nesting-tree, and then discovered my hiding-place. Of all the scoldings I ever got, that from the owls, this evening, was the severest. As I moved away I recalled the oft-witnessed scene of the king-birds worrying crows. It was the same thing in my case. Keeping just out of reach of my cane, they swooped about my head and snapped their bills viciously. They did not dare to strike me, but they came unpleasantly near, and it was with a feeling of comfort that I finally reached safer quarters.

A chance conversation discovered to me one companion of many of my walks. When a mere boy, Uz Gaunt lived in this neighborhood, having a little cottage adjoining my grandfather's woods, and he, above all others, gave me my first lesson in practical zoölogy. Of the stories which he would tell when he was in the humor, the following talk about turtles is a specimen:

"Christmas of '77 was a green one, you may remember," remarked Uz, as he shook the ashes from his pipe. "It didn't need any hickory-logs blazin' on the hearth, such as these," and he stirred the ashes and rearranged the wood on the andirons as he spoke of them. "The weather had been mild for a long time, and once I heard frogs singin'. Well, this kind of thing sort of came to a focus on Christmas-day, which was warm even in the shade. The river was low, the meadows dry, and the crows as noisy as in April. I felt sort of restless-like, and took a walk in the meadows. I left my gun home, and thought I'd just look 'round. Without thinking of them when I started out, I wandered over to your marshy meadow, and began pokin' about with my cane for snappers. You know I take kindly to a bowl of snapper-soup of my own fixin'."

"Yes, I do that, and can run along neck-and-neck with you, when you're the cook."

"Well, I followed the main ditch down, jumpin' from hassock to hassock, and kept probin' in the mud with my cane, when, after a bit, I felt something hard at the end of my stick. It wasn't a stone or a stump, I knew at once. There was a little tremble run up the stick to my hand that told me that much—a sort of shake, as though you hit an empty barrel, as near as I can tell you. I'd a turtle down in the mud, and concluded to bring it out into the daylight. There's more than one way to do this, but none of 'em is an easy job to get through with. I kept probin' 'round him, to try and make out where his head was, and then I could feel for his tail, and pull him out. Now this does very well for one of your common snappers, but didn't work so easy in this case. I could sort of feel that turtle all over the meadow.

Wherever I put my cane down, I seemed to come to his back shell; but after edgin' out a bit for some time I could make out the rim of it, and I tell you he was a whopper, accordin' to my probin'. That turtle seemed about as big 'round as a wash-tub, and I got regularly worked up about him. I wasn't in trim for huntin', but didn't care. I'd found a turtle that was worth havin', and I meant to have him. Probin' showed that he was about three feet deep in the mud, but I made up my mind to locate his tail and then reach down for him. So I did, but it was no use. I felt about, and got one ugly scratch from a hind-foot, but he kept his tail out of reach, or hadn't any; I didn't know which, then. After thinkin' a spell, I concluded I'd try to get a pry under him, and went for a fence-rail. It took me some time to get what I wanted, and when I got back that turtle had got out. I probed all 'round, but he'd moved. This rather took me down, but I kept up my hunt, and after a bit found he'd moved straight for the main ditch, and was tearin' up the mud on the bottom as he went. This was all that saved him for me, and I no sooner learned his whereabouts than I went for him in earnest. I ran the rail I had right under him, and tried to lift him up. Thunder and lightnin', boy, you might as well try to lift a steer! I disturbed him, though, and checked his course a bit. Jammin' the rail down again, I guess I hit his head, for it riled him, evidently, and he raised right up. His head and neck came out of the sand, and I was for standin' back just then. If ever you saw a wicked eye, that turtle had one, and his head was as big as my fist. Stickin' his head out, though, gave me the knowledge I wanted. I knew how he laid in the mud, and I ran my rail down under him as far as I could. It kept him from divin' down, and I went right into the ditch to try and get a hold on his tail if I could. This I did, after feelin' for it a bit, and no sooner had I got a good grip on it than the old fellow got free of the rail and commenced goin' deep into the mud. I tugged and he dug, and it was a clear case of 'pull Dick, pull devil,' between us. He was gettin' the better of me, though, for I was gettin' chilled in that water, and had nearly lost my hold, when the turtle gave an extra jerk, and if it hadn't been for the fence-rail I'd a lost him. I was pulled for'ard, but the rail was right in front, so I put one foot on it, to keep from sinkin' any deeper in the mire. This bracin' gave me the advantage now, and I put all my strength to it. The turtle came a little, and I seemed to gain strength. I tugged and tugged with all my might, and presently his hind-feet showed. You see, he hadn't firm enough mud to hold on to. I backed slowly across the ditch when I got him in open water, and got a fair footin' on the ditch-bank at last. Still, I wasn't out of the woods by a long shot. That turtle weighed close onto seventy pounds, and I'd no means of handlin' him. Chilled through, with both hands needed to hold him, and in the middle of the mucky meadow, all that was left me was to try and drag him to the high, smooth meadows. It was

a tough job, I tell you. I had to walk backward, and he pulled against me like a frightened horse. I gained a little, slowly, and after a bit got on the high ground. Then I felt more at ease and took a rest. I couldn't take him home, of course, in the same fashion, but I had a chance to let him loose, and rest my hands. How I looked 'round for a bit of rope to bridle him! It was no use, though, and after all I was likely to lose him altogether. After a minute's thinkin', it occurred to me I'd make a hobble out of my shirt and then slip home lively for the right sort of tackle. I wasn't long in gettin' the shirt off, and I twisted it into a sort of rope and hobbled him with it. It was a desperate, odd-lookin' turtle when I got through, and I laughed at him a bit as I turned toward the house. You see, I left him on his back, and his legs bound so he couldn't use 'em to turn over. I skipped pretty lively, I tell you, for that mile or so twixt me and home, and was in a good glow when I got in. Hettie looked kind o' scared when she saw me, but I put her mind to rest in two words, and soon was on my way back. A bit of rope and my sheath-knife was all I needed. I skipped over the fields pretty lively, and was soon again in sight. Now, I don't think it was an hour, by some minutes, before I was back on the high meadow, but, by gracious! it don't take long for scenes to change in natur' any more than it does in a theatre. Of all queer sights, that was the funniest I saw when I got back. The turtle had got half free of my old red shirt, and was pawin' the air like mad, tryin' to get on his feet again. I could see that much a long way off, and put on extra speed; but when I was about fifty yards off I stopped short. There was that turtle wrapped in my shirt, and a pesky skunk sort of standin' guard over him. Now, I hate skunks! They don't pay to trap, and they rob my hen-roost every winter. I was afraid to frighten him, too, for fear he'd spoil my snapper, and I wanted the value of a shirt out of the turtle, if nothin' more. I walked a bit nearer, to make sure of how matters stood, and it was clear as day, the skunk thought he had a good thing of it, if he could only kill that snapper. I thought the same way, and didn't want to be bettered by a pesky skunk. I made up my mind to jockey about it, a little; and so, first, heaved a stone at the critter. It gave me a look and started on a slow trot, but it was all up with me, sure enough. He shook that thunderin' old brush right at the turtle and—well! if he didn't sicken the snapper, he did me, that's certain. I stood the racket a bit, though, and tried to move the snapper, but it was no use; I couldn't keep at it long enough to do anything, and don't believe it would have amounted to much anyhow. I got a stick and put the snapper on his feet, as well as I could, without touchin' him, and he waddled off for the mucky meadow, with most of my shirt still stickin' to him, and plunged into the ditch as soon as he could."

"So you lost the turtle after all," I remarked in a low tone, not feeling sure I had heard the last of the story.

"No I didn't either," Uz replied quickly. "Don't set me down for such a fool as that. I knew well enough the turtle wouldn't wander far, so I kept him in mind, and the next April I went out in proper trim and hunted him up. I found him after two days' huntin', when I got a dozen big ones besides, but he was the king of the lot. He couldn't turn 'round in a wash-tub, and weighed somethin' over seventy pounds. I looked all over him for some sign of my shirt, but there wasn't a thread left."

"How old do you suppose he was?" I asked, when Uz had concluded his story.

"I'm not sure I can say, but he was no chicken, that's certain."

"According to Professor Agassiz, a turtle a foot long is close to fifty years old," I replied.

"Fifty years old! Then my big snapper came out of the ark, I guess," remarked Uz.

SCIENTIFIC PHILANTHROPY.

By LEE J. VANCE, B. S.

THE nature and purpose of our modern philanthropy—indeed, the inquiry whether or not utilitarian or altruistic considerations should inspire and control our actions—constitute an important and most instructive study in sociology. In the article on "Scientific Philanthropy," translated from the "Revue des Deux Mondes," and published in the "Monthly," 1883, this view of the question in its ethical aspect was almost entirely overlooked. The writer, M. Fouillée, has, with much ability, controverted the arguments early advanced by Malthus, but latterly by Darwin, Spencer, and others, who have approached the problem from a purely scientific stand-point. The author invites criticism by stating some conclusions, the validity of which sociologists high in repute are quick to question. And treating of Philanthropy as scientific, he has proposed a subject world-wide in its application and interest; and it is proper that the incorrectness of his conclusions be pointed out in the same Monthly that published them for American readers.

Philanthropy is founded in sentiment, and in the desire on the part of the strong, the favored, and the fortunate, to assure the comfort of the weak, unfavored, and unfortunate. It becomes scientific when those severe and exact logical methods of procedure—the indispensable prerequisites to a thorough knowledge of the preparatory studies of biology and psychology—are used in determining the effects of the laws of physical and moral heredity with natural selection on the increase and movement of population. First, we have to deal with those moral foundations which, as M. Fouillée declares, are of such

moment, though so greatly "misconceived" by Mr. Darwin and his partisans. Long before Darwin, Mr. Spencer, in his "Social Statics," inquired: "For what faculty is it, whose work a poor-law so officiously undertakes? Sympathy." Darwin labored under the same misconception, for in the "Descent of Man" he says that the aid we feel impelled to give to the helpless and incompetent is mainly the result of sympathy, originally acquired as part of the social instincts, and subsequently rendered more widely diffused. Thus, the necessary datum of ethics lies in the principle, that each man must recognize and respect the rights and claims of another, equally with his own. It follows, then, that benevolence and justice spring from the same moral sentiment which is the foundation of every form of philanthropy. If the question was one of pure ethics, it would be legitimate to inquire, Ought philanthropy to preserve those who, from a mental and physical point of view, are not fit to be preserved? Is it right that the scanty means of subsistence should be at the command of individuals who, by their own conduct, have no claim for relief? In reply, it may be confessed a delicate task to draw the line of demarkation sharply. The warfare waged in ethics has been at last transferred into the domain of sociology. The two widely different systems of social science—the one treating the topic by utilitarian methods, the other by the way of altruism—is the logical outcome of the rival claims of utility and intuition to be considered the rightful premises in all moral differences. To the one it is objected that self-interest is developed entirely at the expense of natural sympathy; against the latter it is urged that the feelings of sentiment are allowed to control in shaping the policy of public relief, instead of using the slower and more cautious methods of reason. The principle upon which the sentimental school is founded is co-operation, whereby the weak in body or in mind, without struggle, share alike with the more vigorous and prudent. The scientific sociologist starts with the competitive theory of life, whereby in an advancing society, with the agglomeration of population in great centers, it is everywhere seen that industrial virtues are more and more the high rewards of mental and physical vigor, while poverty and pain are the attendant penalties attached to weakness, idleness, and imprudence.

Scientific Philanthropy is based on the intimate scientific connection between biology and sociology, first enunciated by M. Comte; is an attempt on the part of science to control the struggle, not only of man with Nature, but of man with man. Its conscious aim is, therefore, to overcome the harsh and rigorous effects of certain known biological laws. With successive differentiations of individual functions and pursuits there comes an increasing specialization of each differentiated member of society, and hence industrial virtues or vices which the parent fixes for the child by heredity leads to the existence of two very different classes in the community—the rich and the poor,

the strong and the weak, the rulers and the ruled. As population becomes denser and denser, the contrast between the classes becomes still more marked, and we find in the cities poverty, hardship, and suffering, face to face with wealth, luxury, and ease. This is, in truth, the social problem. The sympathetic party, who regard this state of things in society as unjust and wrong, because unequal, invoke the assistance of Government, in State education, in public institutions, and in State Boards of Charities. The question may be stated thus: Does scientific philanthropy render the vital competition between man and man more *unequal?* Or, as a question for the legist, it becomes: *What public duty of relief does the State owe to its citizens?* It seems to us that these questions constitute the problem of philanthropy in its widest significance, and no apology is needed for treating them in detail.

M. Fouillée has fallen into the common error of supposing Malthus a determined enemy of all charity, quite overlooking the fact that he has devoted a most appreciative chapter to "the direction" of our benevolence (Bk. IV, chapter ix). As currently reported, the Malthusian theory would exclude all notion of public relief. Pushed to the extreme, it asserts that when the improvident bring into the world human beings for whom there is no subsistence, then we should leave to Nature, and not to man, the duty of dealing with the surplus of individuals. The Government should not step in and provide for the foolish improvidence of the father. To do so would only act as an encouragement to the lower classes to multiply at a faster rate than the better members of society. Moreover, it is quite irreligious to suppose a good Creator would in this way increase the miseries and privations of life. It is His justice to cut off those who have not "the slightest right to any share in the existing store of the necessaries of life."

Malthus aptly illustrates that all men are Nature's guests; but some are entitled to partake of the viands, while others stand uninvited, no covers being laid for them "at the great banquet of Nature." Here Philanthropy interposes and asks what right have the first guests at a *free* banquet, after they are filled, to keep others from coming for their share? In the struggle for seats at Nature's banquet, shall the strong and vigorous turn back the chairs, and refuse to let the weak partake? Philanthropy insists that there is plenty of room at Nature's table, and that all men shall participate in a feast where priority gives no one any exclusive right. *Vita sedat, uti conviva satur.*

These arguments seem at first glance unpitying, especially to tender-hearted people, who deplore the harsh manner in which Nature punishes ignorance and incompetency as rigorously as froward disobedience. M. Fouillée is indignant over the effort of Malthus to show us the justice of Nature's discipline, whereby in the poverty of the

incapable, in the suffering of the imprudent, and in the early death of the intemperate and unhealthy, there is a far-sighted benevolence. He declares that, in order to escape the objections of moralists, and to solve the question of public relief, Malthus had "recourse to Nature, which knows neither pity nor justice; he should have appealed to the reason and freedom of man." While the accusation is not an eminently just one, yet it showed a profound misapprehension of the real nature and purpose of our modern philanthropy. The conscious aim of scientific Philanthropy is, in the first place, to deal with the struggle of man with Nature—is to help men to help themselves; secondly, its aim is to regulate the struggle of man with man—is to help men to understand and adapt themselves to the conditions of existence. It is commonly noticed that the individual who succeeds in his struggle with Nature is apt to be successful in the good-natured struggle with his fellow-men. As Darwin proves, the intemperate suffer from a high rate of mortality, and the extremely profligate leave few offspring. There is economy in this process of elimination, whereby the transmission of the industrial vices is restricted, and, in the competition of life, the degraded members of society, unable to adapt themselves to the conditions imposed by physical and social environment, succumb before the rest of the population. The scientific idea of benevolence involves, first, the preparation of man to receive intelligently Nature's stern discipline—that is, to help him avoid all the evils coming from disobedience of physical agencies, and also to aid him in grasping those great rewards, which, as Huxley says, Nature scatters with as lavish a hand as her penalties. The philanthropist will show us that the hereditary vices which the parent establishes for his children and his children's children meet in the long run with certain punishment. If we could believe in the certainty of punishment, says Sir J. Lubbock, temptation, which is at the root of crime, would be cut away and mankind would become more innocent. The penalties attached to the consumptive, scrofulous, or syphylitic, in contracting marriage, are sharp and sure—ofttimes swift and merciless. Men sin from a mistaken idea of what constitutes to-day's pleasure and to-morrow's pain; and it is not pleasant to be reminded that a great deal of our suffering is due more to ancestral errors than to our own.

There is no possibility of a right understanding of the nature and purpose of Philanthropy without considering the three forces which, by their intricate interaction, combine to make the individual man what he is, natural selection, environment, and heredity. The process of elimination is nothing more nor less than the slow but steady selection of those who give evidence of their better adaptation to those external conditions into which they are born. No matter whether individuals survive, either for their mental or for their physical vigor, these qualities, for which they are selected, once gained and afterward enhanced by increased selection and heredity, become the

varied faculties of the men and women of to-day. It is to be observed, in this connection, that any character which helps in any way its possessor is liable to be seized upon, and in terms of sexual selection it may be stated that variations which appear first in either sex early in life are transmitted to both sexes; but variations which appear in either—late in life are transmitted to one sex only. A disease may be sexually limited—as gout, when caused by intemperance during manhood, is developed in the sons in a more striking way than in the daughters. The principle of selection with the survival of the fittest encourages the multiplication of those persons best fitted for the conditions of life, by carrying off the weak and sickly who are least fitted for those conditions; and, if left to work without check, it would result in the slow and steady improvement of the individual faculties and race characteristics, by purifying the blood, invigorating the energies, and strengthening the social instincts. But we civilized men, says Mr. Darwin, do our utmost to check the process of elimination; we build asylums for the imbecile, the maimed, and the sick; we institute poor-laws; and our physicians exert their utmost skill to save the life of every patient to the last moment. The effect of the survival of all those who would be eliminated by the principle of selection, together with the rapid rate of increase of the reckless and degraded over the stronger and better members, is to increase the pressure of population on the means of subsistence. This it is which gives rise to the so-called "social problem." Scientific philanthropy is, therefore, the most modern attempt to deal with this problem, which began in primeval times, because of man's rapid multiplication, and which will continue as long as civilization continues.

Mr. Spencer has laid down two propositions which form the basis of M. Fouilleé's article, and also of his attack. They are: "The quality of a society is physically lowered by the artificial preservation of its feeblest members; the quality of society is lowered morally and intellectually by the artificial preservation of those who are least able to take care of themselves." To the first proposition it is objected that Mr. Darwin and his "partisans" exaggerate the harm caused by philanthropy in prolonging the propagation of the weak and helpless; that it applies "only to the infirm properly so called to whom philanthropy is accustomed to give assistance"; that it proves, moreover, too much. In regard to the influence which philanthropy exercises upon the environment, Mr. Darwin's argument may be turned back upon him, says M. Fouillée, and he proposes his theorem—i. e., "the normal conditions most favorable to mankind are to assume the development and selection of a majority of the strong, while saving only a minority of the weak." Such, in their strongest terms, are the arguments brought forward against a truly scientific philanthropy.

Let us examine the exaggerations which the Darwinians are wont to indulge in. If the feeblest members of society are artificially pre-

served, can they hope to compete on *equal* terms with the strongest members, who would alone have survived? Is it true that the strong and competent are called upon to help the feeble and incompetent, who, by the marriages of the imprudent, would succumb either to competition, or to the action of the environment?

The melancholy Burton said: "A husbandman will sow none but the choicest seed; he will not rear a bull or a horse except he be right shapen in all his parts, or permit him to cover a mare except he be well assured of his breed." He inquires: "*Quanto id diligentius in procreandis liberis observandum?* And how careful, then, should we be in the begetting of our children!" Says Mr. Darwin, man scans with scrupulous care the character and pedigree of his horses and cattle before he matches them, but, when he comes to his own marriage, he rarely, or never, takes any such care. By giving the feeble a better chance to propagate their kind, philanthropy is only filling the world with the "infirm so called, to whom philanthropy is accustomed to give assistance," as well as keeping out the vigorous, who, it is assumed, will give assistance to the feeble members.* The harsh result springing from a misguided benevolence is seen in another way. If we take care of the feeble and helpless, the diseases that appear in their race must be met by new remedies; and new causes of death have arisen from our philanthropic anxiety to suppress former causes of mortality in the feeble. To save and keep alive the weak to-day from injurious influences is to save and keep alive their descendants from totally different influences to-morrow. We suffer from diseases which were quite unknown to our ancestors, of the last century even. The inflammatory and febrile disorders from which they suffered have given place to disorders distinctly American. The neuroses, or nervous diseases, are doubtless intensified by the restless activity which characterizes the social, political, and industrial pursuits of our people; and cerebral difficulties of many forms which appear as types of nervous diathesis developed by our climate and institutions have now become functional.†

It is difficult, therefore, to exaggerate the harm caused by the artificial preservation of the feeblest upon the physical status of future generations. The great harm consists in still further separating classes, and thus creating great inequalities of condition in every society. The artificial preservation of the feeblest is the artificial widening of those lines which Nature draws between one person and another; it gives rise to those natural differences among men which, as Mr. Galton has

* "Descent of Man," 1880, p. 617; *vide* p. 138.

† Compendium Tenth Census, part ii, p. 1665: "The tendency to insanity among the foreign . . . may be accounted for, etc., by the change of climate and of habits of life; by increased anxiety and effort to advance in social respectability, by home-sickness, and in general by removal of props which sustain a man who does not emigrate." Even the same tendency is noticed with native-born who move, "especially from the Atlantic to the Pacific coast."

shown, are greater than many ever suspect. From Rousseau's discourse on the Origin and Grounds of Inequality among Men, down to the writings of Henry George, this condition in society is looked upon as the root of all our social evils. The philosophy of common socialism aims at equality in all things, but fails of realization because men are born unequal in everything. To make out a case against Mr. Darwin and his "partisans," M. Fouillée claims they insist that no deformed or weakly child deserves to survive, but they say, "Woe to the weak!" and "the Spartan method of disposing of feeble children will be that of the perfect sociology." Such an accusation and its utter absurdity deserve hardly passing reproof. Mr. Darwin expressly argues that, if it were intentionally to neglect the weak and helpless, it could only be for a contingent benefit, with an overwhelming present evil. What Mr. Spencer claims, and what is claimed in behalf of scientific philanthropy, is simply to regulate, by healthy and moral modes, the increase of the improvident on the means of subsistence; and this the true philanthropist will do by teaching the laws of health, by right physical education, and by wise sanitary measures. So insalutary are the conditions of the environment of the poor in the cities, that only by fitting themselves to unfavorable conditions is life worth living. This civic population suffer from zymotic diseases due to overcrowding; their drinking-waters, laden with the germs of parasites and fevers, if they do not beget febrile disorders, generate diseases of the liver and spleen; while goitre and thyroid from limestone waters, and pellagra and ophthalmia show themselves at the first favorable opportunity. Poverty always tends to be sickly, because it is continually exposed to the attacks of unhealthy influences. The surroundings during confinement exercise a potent influence upon fœtal nutrition. The Greeks were solicitous in having the female surrounded by symmetrical works of art, but in the upper rooms of the tenement there is no place for the *Lares* and *Penates*.

Philanthropy does not have to deal alone with poverty and improvidence and its attendant evils. To be born rich and feeble is as bad a fate as to be born poor and capable. There is a kind of material success which, when it destroys men's finer moral and intellectual faculties, is a greater curse than the worst kind of hardship. "The chief advantage of poverty as a sanitary or hygienic force," says Dr. Beard, "is that in some natures it inspires the wish and supplies the capacity to escape from it, and in the long struggle we acquire the power and the ambition for something higher and nobler than wealth; the impulse of the rebound sends us farther than we had dreamed." Baron Niebuhr was the first to observe that the wealthy Roman families were short-lived, and perished from the effects of luxury and ease; and the same has been done by Mr. Freeman in English history. The Cæsars, the Valois, the Bourbons, and the English lords, either from vice, idleness, or impotence, were doomed to family extinction. The

trials and dangers of childbirth, sterility, incapacity, and nervous disorders, are the coming events which cast their shadows "in the depths of folly and degeneracy." Mr. Galton regrets that he is unable to decide how far men and women who are prodigies of genius are infertile. It would seem, in answer, that where parents have undermined their vitality and their health, by mental or physical overwork, where their activities and powers have been attained at the expense of their physical system, like the most highly cultivated types of vegetable growths, they will beget no germinating seed.

The arguments brought by M. Fouillée against the second part of Mr. Spencer's proposition are of two kinds—the one proposing an altruistic test for benevolent action, the other holding that the law of mental and moral heredity is much "more vague and loose than the law of physical heredity." Let us examine, briefly, the first objection and see what it is worth. Suppose, for example, a man commits a crime, or violates any established law of society; he is punished, either lightly or severely, according to the nature of his act. Conversely, when the intemperate are well aware that hard drinking will cause suffering, and the *blasé* wight knows that his profligacy will produce sickness and disorders, these trangressions are treated with excessive leniency. Paradoxical, then, is the doctrine, held overtly, that the individual who hurts others shall be treated rigorously, but that the individual who hurts himself shall be treated forbearingly. Hence the best specific for vice and crime is the sharp suffering which flows inevitably from vice and crime. Take, also, that distribution of money, "prompted," says Mr. Spencer, "by misinterpretation of the saying that charity covers a multitude of sins." The ignoble action of Evagrius, a Pagan, when he gave his three hundred pieces of gold to the bishop, must be condemned, for he demanded and received a promissory note to be paid in the other world. Take, again, those ostentatious donations by which the donor invites not only present approbation, but bids for posthumous fame and honor; and it is not strange that many eleemosynary institutions intended to perpetuate the bounty of their founders are admired as monuments to personal pride. The elaborate study of Mr. Bain has shown that the love of applause, the feeling of praise, the desire to win the respect of our fellows, even the fear to merit their condemnation, spring from the instinct of *sympathy*. Indeed, sympathy itself is founded upon the instinct of self-preservation; seen alike in that feeling which impels the members of a community to band together for protection, or in that altruism which prompts the strong to help the weak in their burdens. At an early day clover and stramonium were scattered in the fields; and our modern knowledge of poisons, even the invention of dynamite, is due primarily to the instinct of sympathy, though often strangely distorted by fear, malice, or love.

The second part of M. Fouillée's objection is directed toward re-

futing the theorem that the artificial preservation of those least able to take care of themselves will result in mental and moral deterioration by the operation of heredity. He claims that these biological laws are pushed too far ; that Mr. Spencer's conclusions are still more inadmissible than those of his relative to physical deterioration of society. "If any one denies," Mr. Spencer urges, "that children bear likenesses to their progenitors in character and capacity, if he holds that men, whose parents and grand-parents were habitual criminals, have tendencies as good as those of men whose parents and grand-parents were industrious and upright, he may consistently hold that it matters not from what families in a society the successive generations descend. He may think it just as well if the most active and capable and prudent and conscientious people die without issue, while many children are left by the reckless and dishonest." M. Fouillée does not attempt to refute this conclusion, but denies that it bears against philanthropy itself. Mr. Darwin has brought facts forward to prove that our moral qualities are directly due to our ancestors ; that, for instance, kleptomania or a propensity to lie seemed to run in noble families for several generations, and so could hardly be imputed to any coincidence. The same is equally true of the inheritance of that moral quality called character, which, says M. Ribot, "whether individual or national, is the very complex result of physiological and psychological laws." The bold and vigorous traits of Puritan character were transmitted to their descendants ; they began with this advantage over the other races that emigrated here ; hence the fineness and purity of their mental and moral fiber evolved, of necessity, more swiftly leaders in peace and in war.*

On the other hand, it is argued by M. Fouillée that "the two elements which Mr. Spencer and Mr. Darwin have overlooked—education and just legislation—must be reinstated in the problem. He contends that education abrogates the law of heredity ; that good character will result from good education. It has never been satisfactorily explained why education should be the only cure for crime, poverty, and misery. Huxley says, "If I am a knave or a fool, teaching me to read and write will not make me less of either one or the other, unless somebody shows me how to put my reading and writing to good purposes."† The zealous educationist is too apt to forget that the weak and vicious man is fighting single-handed for the mastery over perhaps a score of evil-minded ancestors. We can make education compulsory, but we can not compel the conscience. To suppose that education will supply those inherited faculties of moral intuition that

* *Vide* "Data of Ethics," 1883, pp. 191, 192; also Mr. Spencer's "American Address."

† That rough moralist, Jack Cade, when he learned that the clerk of Chatham had been setting boys copies, said, "*Here's a villain!*" Also *vide* "Study of Sociology," chapter xv.

are missing—"certain emotions responding to right and wrong"—is parallel with the supposition that the individual may be born again by a kind of mental baptism. The true effect of intellectual training is to clothe heredity with renewed power, giving the children a moral vantage over the parent, and enabling them to leave to their descendants a much further development of the faculties thus fostered, and a still higher power in producing beneficial variations which are a blessing to the race.

It now becomes necessary to inquire, What is the public duty of relief? It will not be disputed that the function of government is to maintain the equal rights of all its citizens; it owes them in the first place justice. When the state undertakes to appropriate annually from the tax-payers millions of dollars for the support of the incapables, it is taking money from the former in no wise for the maintenance of *their* rights. The more the state does for the improvident the less it does for the provident. It is conceded that the right of government to educate the illiterate and to check the vicious is a just one; because it is a duty society owes to itself. The State is under no moral duty to take care of the least of its citizens; but somehow our doctrine of political equality has evolved the socialistic idea of economic equality. Stuart Mill put state aid in this way: The laborer out of work says it is the duty of society to find work for him; but surely it is his duty as a member of that society to find work for every other unemployed man.* As an organized business, with paid executive officers, numerous employés, and bureaus of distribution, modern philanthropy has become a thriving profession. Asylums have been built to keep pace with the increase of the insane; hospitals are founded to meet the constant wants of imbeciles; and almshouses are being erected to accommodate the number of paupers. In this State twenty-five years ago there was one pauper to every one hundred and thirty people, now there is one to every thirty! The charities of the city of New York are something enormous, whether we consider the money spent or the two hundred and fifty charitable organizations. The poor in New York can be born in a public hospital, educated in a public school, clothed and fed in a public reformatory, and doctored in a public dispensary; if they die, it is at public expense they are buried. In a single phrase, metropolitan charity has fully provided for every want from the cradle to the grave.

In the report of the State Board of Charities,† the committee say:

> The pauper, the insane, the deaf-mute, and the blind, appeal to charity; but these juvenile offenders excite both pity for their own condition, and solicitude for their potential influence for evil in society. Some of them show evidence of congenital deformities and defects. . . . It is from the ranks of these that the Communists and Nihilists of the future may be recruited. Whatever may be

* See further, "Political Economy," vol. ii, pp. 590, 591.

† The Fifteenth Report of the State Board of Charities, p. 157.

the theory of punishment for persons of mature years, there can be but one opinion with reference to the duty of the State to these, its wards and weaker members.*

The Department of Charities and Corrections in New York city is controlled by three commissioners, who have under their charge some six hundred employés and about twelve thousand dependents. As is justly complained of in the above official report (see pp. 289–291), the appointment of the commissioners is part and parcel of municipal patronage, and it is declared that the whole tendency of the system is to encourage the increase of pauperism and crime. It is estimated that over seven millions of money are spent annually by public and private organized charity in New York city alone; yet improvidence and dependence remain exactly as the year before. The report of the public charities of that city is a startling document; it shows how much misery is due to a lavish, unsystematic, and misapplied benevolence. In speaking of the money expended by out-door relief societies, to the number of sixty-six, the report says:

> Thus we have an aggregate of $546,832 spent in this kind of charity in New York city during the year 1880; $157,610 of this sum being public money, while about 525,155 cases are reported as having received oneform or another of charitable relief. . . . The foregoing figures, whether we regard them from a financial or humanitarian view, are sufficient to convince us that so important a business as the administration of charity in New York city requires to be carried on on business principles, if the great evils of wasted funds and corrupted and pauperized citizens are to be avoided. Some system is required to enable these various societies to work in harmony. . . . That there is not some such system in New York is a matter of regret . . . to most thoughtful persons who have practical experience, especially as almost all other large cities in this country and in England have proved the value of associated work in diminishing pauperism and poverty in their midst.†

In the interesting report for 1884, the Committee on Out-door Relief say of Kings County, New York, as follows:

> Until 1879 public out-door relief was given by the county to the amount of $100,000, or more yearly; it was then cut off in the middle of winter, without warning, without any substitute being provided, and the result was—nothing. In fact, except for the saving of money, and the stopping of political corruption

* The *proletaires*, though short-lived, intemperate, improvident, and decimated by fever and disease, nevertheless remain the same, continually receiving scores of their own children as recruits to their ranks. It is among the children of this class that the Children's Aid Society has accomplished its work in New York; and according to the report of Mr. Brace, the secretary, for 1883, among the many thousand children sent to the West, with few exceptions, they have grown up to have an honorable standing in the community. It goes to show that hereditary taints may be in part ameliorated by the softening influences of a congenial environment.

† The Fifteenth Report of the State Board of Charities, 1882–'83, p. 322. "Compendium Tenth Census," p. 1665, stated only thirteen out-door poor returns for Boston—a very comfortable income for each for amount of money spent.

carried on by means of relief, and the cessation of the spectacle of hundreds of people with baskets of provisions furnished by the public, it would have been impossible to discover that relief had been stopped. (See pages 8 and 9 of report for 1884.)

The Poor-Law Commission of 1834 * demonstrated beyond controversy the pernicious effects of out-door relief, and it has never been satisfactorily ascertained why the system that was half a century ago condemned and abandoned in England should work with beneficial results in this country. It was with the express purpose of correcting these well-known abuses that the *Charity Organization Society* was established last year in New York city. Its purpose is, as set forth in the official circular, to enlist the co-operation of the charitable societies of the city in establishing a central exchange; to aid the deserving poor in securing employment; and to relieve actual want. Secondly, it will disburse the funds of the giver in a systematic manner so as to prevent imposture. In the past, fraudulent begging was as well organized as the relief sought, and it was often found that the same person was getting aid from half a dozen different societies at one time.†

From the statements already mentioned, it follows that modern Philanthropy has been a great waste of money, effort, and sympathy—has been the means of diffusing habits of improvidence, idleness, and servility in the poorer classes. To aid the good-for-nothings to multiply, says Mr. Spencer, is the same as maliciously providing for our descendants a multitude of enemies. There is, however, a peculiar tendency among certain sociologists to exaggerate the present evils of society, either overlooking or neglecting those of the past and future. The novelist, the *littérateur*, and the *doctrinaire* find plenty of facts at hand to prove the enormous increase of human wretchedness. When social evils are prominently before the people, these persons either rush off to the Legislature to have a new law passed, or they get together a score of individuals and form a new charitable Association. There is a blind and unthinking faith in the paternal functions of the State; as if the social structure was founded upon the *régime* of status, instead of contract, express or implied. All modern relief has proceeded upon the ground that it is the duty of those who have supported themselves to support others, and the good citizen is obliged to shoulder the burdens of the good-for-nothing in addition to his own. If Quashie is idle or incapable of work, the State may say, on the basis of status, "I will feed and clothe you until you find work." Still better

* Poor-Law Commissioners' Report, p. 280.

† Reference is here made to the circular lately issued. The society intends to study the advisability of a system of loans, a bureau of legal relief, the formation of wood-yards to encourage the able-bodied, the labor markets of the United States, and the cost of transportation. The regret expressed on page 322, State Charities Report, is now, in a measure, met.

it would be to give him employment instead of taking care of him. All modern philanthropic legislation has relied upon palliatives; it has undoubtedly ameliorated the near effects of poverty, but unquestionably it has failed to remove its remote causes. We must believe that these social evils of pauperism and crime are incurable, or that the treatment of them is wrong and pernicious.

The latter conclusion leads us all the more to the firm belief that Philanthropy should be established upon a definite and exact scientific basis. In his address before the Academy, in 1880, Victor Sardou said that sympathy impelled men to apply a remedy before they ascertained the cause of the disease—to trust in the efficacy of panaceas, rather than in the *vis medicatrix*. This he called sentimental Philanthropy. The conflict between the sentimental and scientific methods in social science has come from the intrusion of what may be called the sympathetic Bias—that is, the former class allow their emotions to predominate over their judgments, while the latter subordinate their feelings of sympathy to their faculty of reason. The sentimentalist employs in sociology the empiric method; in ethics he builds upon intuition; in political economy he favors the principle of co-operation. The innumerable Reforms, Leagues, and Associations are evidences of the unscientific nature of the remedy administered for deep-seated evils. Therefore, all measures of public relief must depend for their success on the correctness and certainty with which the laws of mental and biological science are applied; and the legist must likewise depend, not on short-lived and hastily-contrived plans for relief, but on the logical precision with which he draws his conclusions from these scientific studies to shape the course of his present and future policy. M. Fouillée declares that the aim of philanthropy will be to establish among the social classes *solidarité*—union between the rich and the poor. In the terms of evolution, our modern Philanthropy will produce a state of social *equilibrium*—"a state of human nature and social organization such that the individual has no desires but those which may be satisfied without exceeding his proper sphere of action, while society maintains no restraints but those which the individual voluntarily respects."* Unhappiness will be the result of imperfect adjustment of faculties to their functions and conditions, while happiness will consist in the due exercise of all the faculties consistent with the similar exercise of the like faculties of others. Without one word of displeasure to those tender-hearted philanthropists who have committed grievous errors by short-sighted plans, let us speak with pleasure of the labors of Arkwright, Stephenson, Whitney, Bessemer, Siemens, and others—scientific philanthropists, who have been all the time "weaving the web of concord among nations." The spirit that animated Faust to dig and drain vast territories has led these practical

* "First Principles," p. 512.

men to cautiously work out the application of the inventions and discoveries in science to art and industry. The difference between the Humanitarian, who is looking at things as they should be, and the sociologist, who deals with things as they are, represents accurately the distance between the Ideal and the Real. The true philanthropist will take that golden mean,—a man who, while maintaining the just equipoise between the emotional, non-discursive side, and his intellectual and analytic nature, will give wide range to his finer sympathies, "so uniting philanthropic energy with philosophic calm."

THE WORLD'S GEYSER-REGIONS.

By A. C. PEALE, M.D.

THERMAL springs, or those whose mean annual temperature exceeds that of the locality in which they are found, are almost universal in their distribution. This definition, of course, includes more than the springs usually called warm or hot, for, if the temperature exceeds, no matter in how small a degree, the mean temperature of the place in which it rises, it is truly a thermal spring. There will, of course, be a variation according to geographical position. Thus a spring which has a temperature of only a few degrees above the freezing-point would be a thermal spring in Siberia, where the ground is frozen constantly to the depth of six hundred and thirty feet, thawing out only a few feet in summer, and where the mean annual temperature is about 12½° Fahr.; whereas, in the West Indies, or in the Eastern Archipelago, it would be a cold spring. Warm and hot springs are also widely distributed. With the exception of Australia, no continent is without them, and even here they may be said to exist in a fossil state, for sinters and siliceous deposits are found in New South Wales, in a basaltic and trachytic region, indicating the former presence of hot springs, and possibly of geysers. Of course, hot springs are less widely spread than those which are simply warm, being found mainly in districts which have been affected by volcanic action, or where the rocks, from which they flow, have been subjected to disturbances such as occur in mountain elevations. Latitude, however, has no effect, for we find them equally hot in the Arctic regions and under the equator.

They are found in the frozen fields of Siberia and on the islands of Alaska, while the Andes have boiling springs from one end to the other. Venezuela and Patagonia, at the extremes of South America, both have their hot springs. When we come to geysers, we find them still more limited in their occurrence, and yet even they are confined to no particular quarter of the globe, for each continent appears to have its geyser-region. North America has the geysers of the Yellow-

stone National Park; Asia, a geyser-region in Thibet; while the Iceland geysers may be considered as belonging to Europe, and the New Zealand field to Australasia. Africa and South America seem to be

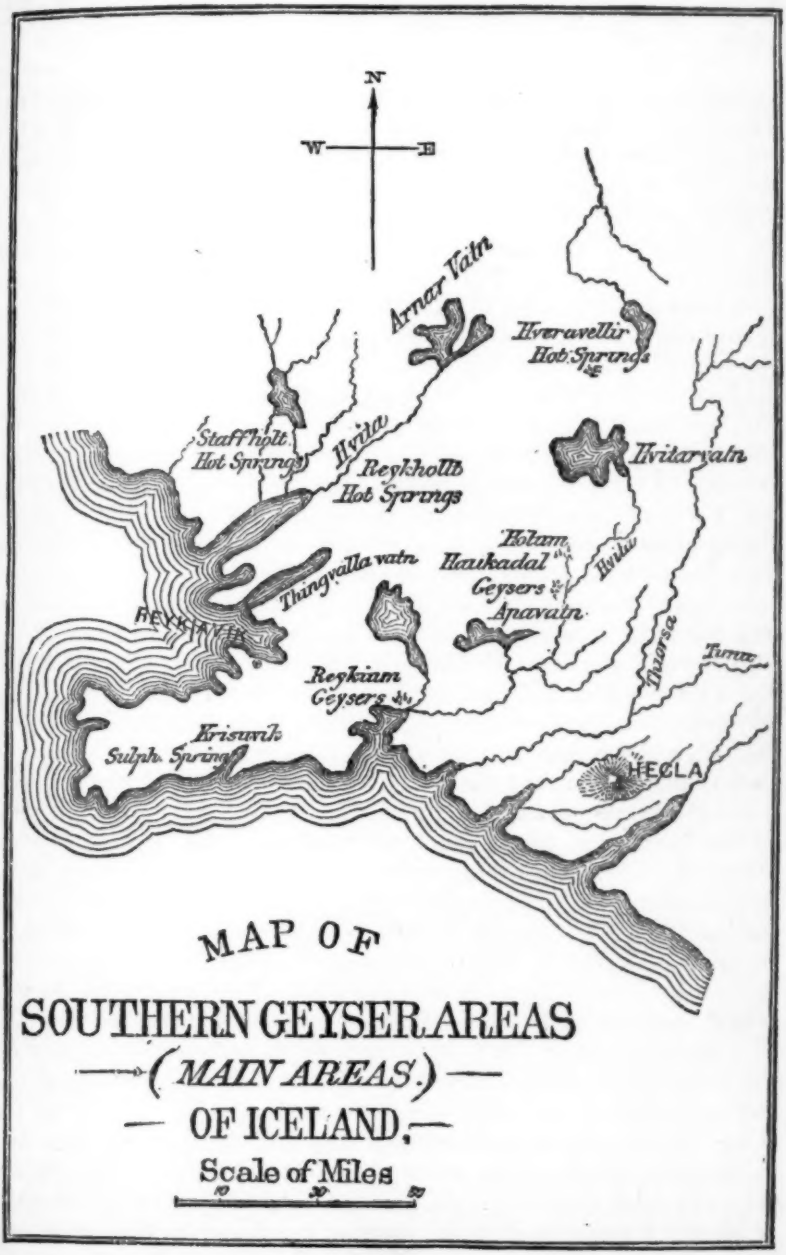


FIG. 1.

left out, and yet the comparatively unimportant geyser area of the Azores can perhaps be considered the African representative, while in the boiling lake of Dominica, and the water-volcano of Guatemala, Central and South America may be said to have geysers on a grand scale.

The difference between geysers and ordinary hot springs is not readily explained, nor always recognized, although the difference between a quiet hot spring and a geyser in active eruption is very marked. However, these are the extremes, and between the two there is every grade of action. Some geysers at times appear as quiet springs, and others are constantly in active ebullition. A geyser may be defined to be a periodically eruptive or intermittent *hot* spring, from which the water is projected into the air in a fountain-like column. The word *hot* in this definition is italicized because springs containing a large amount of gas may simulate geysers, as in the case of the Kane geyser-well in Pennsylvania, which spouts regularly, and the artesian well at Rank Herkany, in Hungary, which is fourteen hundred and fifty-seven feet deep, and spouts at regular intervals to the height of one hundred feet. Nordenskiöld discovered an intermittent cold geyser-like spring spouting through the ice-field of Greenland about thirty miles from the coast. Almost all the constantly boiling springs have periods of increased activity, and those which spout only a few feet into the air have been classed as *pseudo* geysers. There are several localities of the latter in the United States, particularly in California, and Nevada. The geysers of California belong to this class, as do also the mud-volcanoes of Southern California, although some of the latter throw columns of water to the height of twenty feet, and are true geysers. Besides the Yellowstone National Park, the Haukadal area in Iceland, and the Taupo region of New Zealand, which are the geyser-regions *par excellence* of the world, there are a number of places where a few individual geysers are known, besides the Thibet area and that of the Azores. In Mexico, at Aguas Calientes, near San Luis Potosi, there is a geyser which spouts to the height of ten or twelve feet. The Volcan de Agua, or water-volcano, of Guatemala, and the boiling lake of Dominica have already been referred to. The latter has been known since 1777. It is a seething caldron of unknown depth, measuring two hundred by more than one hundred yards, situated in the Grand Soufrière of Dominica, at an elevation of twenty-four hundred feet above sea-level. It is sometimes quiet, with a temperature of 96° Fahr., and at others is in active ebullition, with a temperature above the boiling-point, the water being thrown in jets into the air with a noise like the discharge of artillery. At Atami, in Japan, there are intermittent springs which spout about six times daily, although not with any exact regularity. An immense volume of steam and slightly sulphureted water is ejected. Geysers are found in Batachian, one of the Moluccas, and at Nolok on Celebes there is a bowl-shaped spring

seventy-five feet in diameter by twenty feet in depth that has eruptions reaching the height of fifty feet. There are other localities on the same island, and in Java also are several localities, some of which have mud-geysers that spout twenty or thirty feet. The springs of Savu-Savu on Vanua Levu, in the Feejee Islands, are *pseudo* geysers.

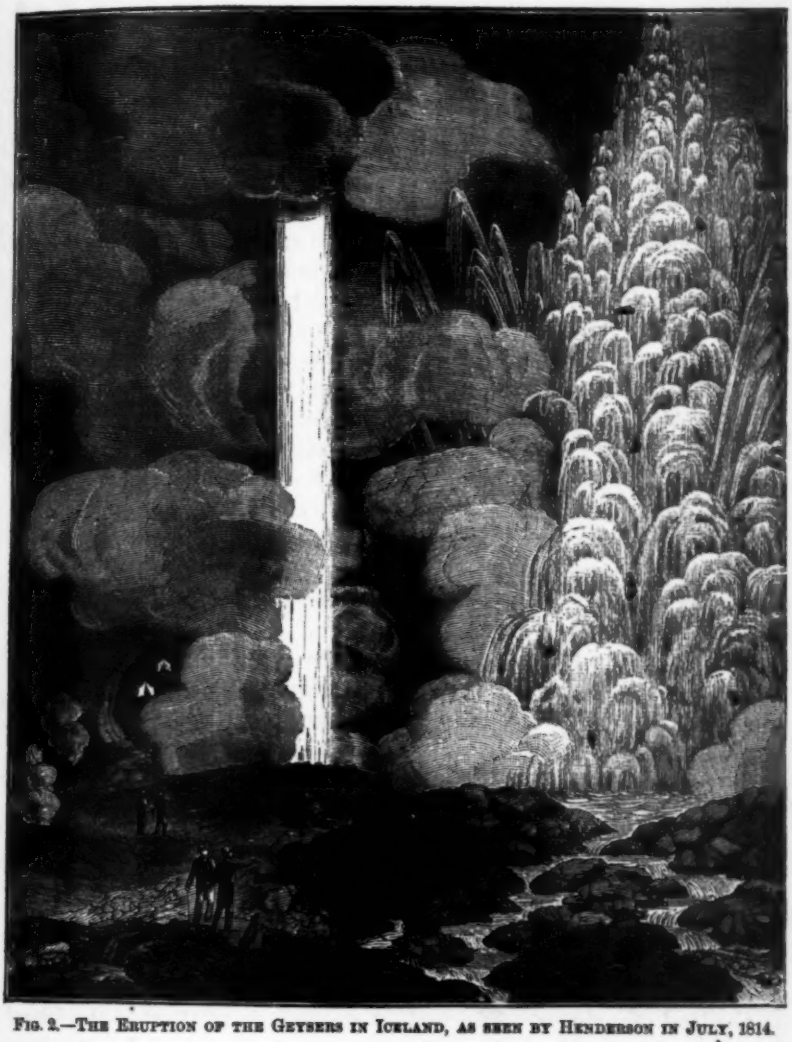


FIG. 2.—THE ERUPTION OF THE GEYSERS IN ICELAND, AS SEEN BY HENDERSON IN JULY, 1814.

The latter were owned by an old woman who was captured by a chief in 1863, and cooked in her own springs. Miss C. F. Gordon Cumming, referring to this, says: "She was past seventy, and must have been very tough and smoke-dried, but as in her younger days she had been a regular Joan of Arc, leading her tribe to battle, and herself

fighting hand to hand with a hatchet, he determined to eat her. So he had her cooked with the sixteen men, and made a great feast, and then to spite the people, before leaving the district, he attempted to choke up all of the springs, in which amiable effort he partially succeeded. These springs were also a favorite place for depositing all superfluous babes, especially girls, who never got much of a welcome. They were popped in alive, like so many lobsters, and treated with quite as little ceremony." Next to the Iceland geysers, which we rank below those of New Zealand and the Yellowstone Park, the most important are probably those of Thibet, although our knowledge of them is very meager. They are in Great Thibet, in the province of Chamnamring, called Chang, near Lake Namcho, or Tengri Nur, and were discovered by T. G. Montgomerie, who described them in the "Journal of the Geographical Society of London." There are six localities in the region, of which the most important are Chutang Chaka, Peting Chuja, and Naisum Chuja. At the latter, the highest temperature recorded was 183° Fahr., and the boiling-point of water was 183¾° Fahr. The first locality had fifteen hot springs, whose waters had a temperature of 166° Fahr., the boiling-point here being 186° Fahr. Peting Chuja is the principal geyser area, and a dozen columns of hot water are described as issuing from a large stony plateau and rising to a height of forty or fifty feet, producing so much steam that the sky was darkened, and so much noise that the travelers could not hear one another speaking. Similar jets were also noticed, rising to about the same height from the middle of the adjacent river, Lakú chu. The stony plateau or platform spoken of is undoubtedly a platform or mound of siliceous sinter, so common to geyser areas.

The Azores mark one of the volcanic centers of the Atlantic Ocean ridge, on which also Iceland lies. The Island of San Miguel, or St. Michael's, has hot springs in all parts, but especially in two places at the West End, in the valley of Furnas. This valley is almost circular, about twelve miles in circumference, and surrounded by volcanic mountains. Through it flows the Ribeira Quinta, or Warm River. The springs are of high temperature, and include some that spout to a height of twelve feet. They are at one end of the valley, surrounded by deposits of siliceous sinter, which forms rims eight to ten inches in height around the individual springs. The "Great Caldeira," or Boiling Fountain, is the principal geyser.

The very name, *geyser*, testifies to Iceland's historical precedence as the land of geysers. The earliest writings in relation to the island are silent in regard to them, the first mention made being by Saxo Grammaticus, who wrote in the twelfth century. Are Frode does not refer to them in the "Icelandic Annals," A. D. 1070–'75, although he lived near their present locality. If they broke forth subsequent to that period, it is surprising that not the least notice should be taken of their appearance. It must be remembered, however, that, in all but

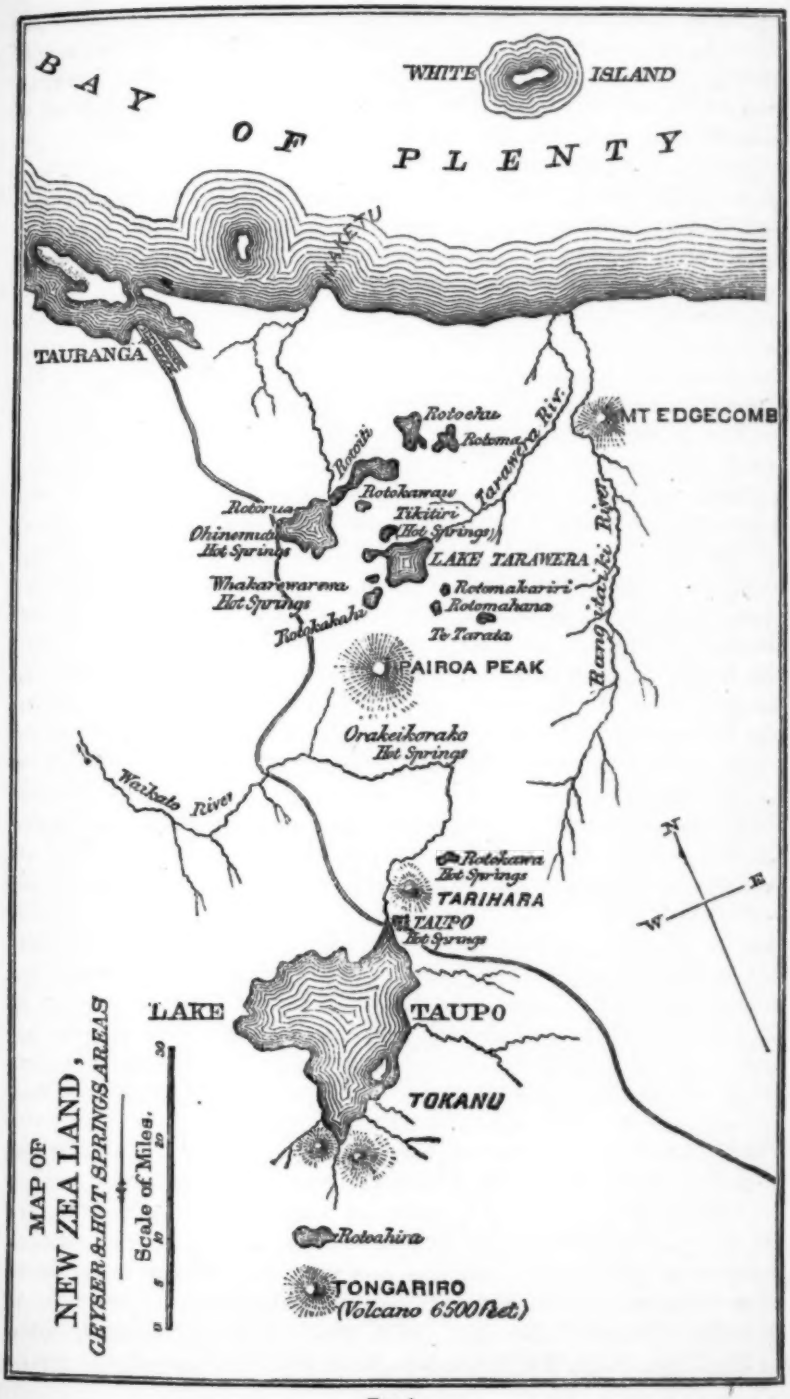

BAY OF PLENTY
WHITE ISLAND
TAURANGA
Rotoehu
Rotoma
Rotoiti
Tarawera Riv.
MT EDGECOMB
Rotorua
Rotokawau
Tikitiri
Hot Springs
Ohinemutu
Hot Springs
LAKE TARAWERA
Whakarewarewa
Hot Springs
Rotomakariri
Rotomahana
Tikitapu
Te Tarata
PAIROA PEAK
Rangitaiki River
Orakeikorako
Hot Springs
Waikato River
Rotokawa
Hot Springs
TARIHARA
TAUPO
Hot Springs
LAKE TAUPO
TOKANU
Rotoaira
TONGARIRO
(Volcano 6500 feet)
MAP OF
NEW ZEALAND,
GEYSER & HOT SPRINGS AREAS
Scale of Miles.
30
20
10
0
N
E
W

Fig. 3.

highly civilized nations, physical events that do not have an immediate effect upon their worldly interests are received with indifference or apathy. Pliny, we know, gives a circumstantial account of the eruption of Vesuvius, A. D. 79, but does not mention the destruction of Herculaneum and Pompeii. It is probable that the Iceland geysers originated in prehistoric times. *Geyser*, *geysar*, *geiser*, or *geisir*, as it is variously spelled, is an old Icelandic word, meaning *gusher*, or *rager*, and is derived from the verb *geysa*, or *gjosa*, to gush, to rage, or to burst forth, to be impelled. In Iceland, in native usage, it is a proper name, being applied not only to the Great Geyser, but also to another fountain at Reykium. The word, however, has become an appellative or common name for the whole class of boiling fountains that spout hot water intermittently, just as the term *volcano* is derived from the name of one of the vents in the Lipari Islands.

The geysers of New Zealand are found on the North Island, scattered through the area which extends from Tongariro (a semi-active volcanic cone), in about the center of the island, to the Bay of Plenty. They have long been known to the natives, who have no traditions as to their age, but from time immemorial have used the quiet hot springs to warm their huts and to cook their food. Every hut has its boiler close to the door; bread is baked on large slabs of stone, placed over the hottest portions of the ground; and on others, not quite so hot, the lazy recline, wrapped in blankets, enjoying Vulcan's heat. In these respects the Maoris have the advantage over our North American Indians, who have always avoided the Yellowstone region on account of their superstitious fears.

The first white man who ever visited what is now the Yellowstone Park was undoubtedly John Colter, who was a member of Lewis and Clarke's celebrated expedition, and returned to the Upper Missouri country in 1807, and passed around Yellowstone Lake, or, as it was then called, Lake Eustis. His tales of the region were so wonderful that it was derisively called "Colter's Hell." As far back as 1844, James Bridger and Robert Meldrum, two noted Western trappers and guides, were said to have described some of the springs and geysers of the region, but their stories were so marvelous that they were not believed. The first printed description ever published was probably that given in a Mormon paper, called "The Wasp," published at Nauvoo, Illinois, in 1847. The unknown writer of this article undoubtedly visited the Lower Geyser Basin of Firehole River. Authentic information of the region was also derived from a prospecting party who visited the Lower Geyser Basin in 1863, under the leadership of Captain W. W. De Lacey. In 1869 Messrs. Cook and David E. Folsom, with another prospecting party, visited what is now the park, and the latter wrote an account of its wonders which was published in the "Western, or Lakeside Monthly," for July, 1870, where it was wrongly credited to Mr. Cook. The Washburn expedition of 1870 followed, the results

of which were published in "Scribner's" and in the "Overland Monthly," attracting universal attention. In 1871 Dr. F. V. Hayden, the 'father of the Yellowstone National Park,' made his first exploration, and published the first *scientific* account of its phenomena. Since then it has become known all over the world. Thousands of tourists have visited it, and the bibliography of the park includes a list of nearly one hundred publications in relation to it. Space here will not permit a de-

FIG. 4.—LOWER TERRACES OF TE TARATA OR WHITE TERRACE GEYSER.

tailed description of the park, nor is it necessary, but a comparison of some of its features with those of New Zealand and Iceland may be of interest. Without having seen each one of the three regions, it is, of course, difficult to make a complete comparison, and certainly it is impossible to be dogmatic. Still, Nature works according to laws that are the same in all parts of the globe, and a view of any one of the localities will, to a great extent, help to explain phenomena observed in either or both of the others. The comparison can be the more

readily made when the American locality is the one actually observed, as the others have long been known, and quite thoroughly studied and described. The maps of the three great geyser-regions present the best comparative view of them. Expressed in figures, the areas within which the springs are included are as follow :

	Square miles.
Iceland	5,000
New Zealand	2,500
Yellowstone National Park	3,578

In the southern Iceland region, which includes the Haukadal locality, there are about six areas or groups of hot springs, which are from forty to fifty miles apart. In New Zealand there are some ten groups, the greatest distance between them being about fifteen miles. In the Yellowstone National Park, there are from thirty to forty localities or groups, some quite close together, and others sixteen miles apart. In Iceland only three of the areas have geysers of note. In the Yellowstone Park eight, at least, have good spouters, and New Zealand has fully as many localities. The following table compares some of these groups. It should be premised, however, that the individual groups included under the Yellowstone Park are not a portion of the thirty or forty localities just enumerated, but subdivisions of some of them. The Upper Geyser Basin and the Lower Geyser Basin of Firehole River are really comparable with the Haukadal area, and yet the first two comprise respectively 2,560 acres and 19,200 acres.

GROUP.	Locality.	Area in acres.	Number of springs and geysers.
Geyser area of Haukadal	Iceland	20	100
Geyser area of Reykium	"	50	100
Siliceous plateau at Orakeikorako	New Zealand	1	76
Te Tarata, and east side of Rotomahama	" "	6¼	85
Castle Group Mound	Yellowstone National Park.	3½	15
Giantess Group	" " "	18	55
Grand Group	" " "	30	70
Fountain Group	" " "	15	17

In the number of springs and noted geysers, the Yellowstone National Park and New Zealand far exceed Iceland, in which "The Great Geyser" and Strokhr are the only two prominent spouters. As to the number of springs in New Zealand, there are no definite data, but they appear to be numerous. In the Yellowstone Park, over two thousand springs have been enumerated and mapped, and among them are seventy-one geysers, of which twenty are known to spout to a height of not less than fifty feet. Of course, in each of the three countries, there are hot springs outside of the areas as here indicated ; and, if these are taken into account, the American localities will exceed the others, especially if the California and Nevada springs are counted.

However, leaving the latter out of account, we find that in the adjacent country both north and south of the park there are springs on the same north and south line with the geyser-basins of Firehole River; and, if they are considered as a part of the same system, the length of the line of thermal activity is about two hundred miles.

As to the heights to which the geysers throw the columns of water, there is probably but little difference between the three regions, although the Yellowstone Park has, perhaps, a greater number which erupt regularly to a height of one hundred feet or more. The records of the New Zealand geysers are, however, somewhat deficient as to data on this point. The following table presents some comparisons as to this:

NAME OF GEYSER.	Location.	Maximum height.
		Feet.
Great Geyser	Iceland	212*
Strokr	"	162
Geyser at Reykium	"	40
Waikite, at Rotorua	New Zealand	100
Te Puia-nui, near Tokanu	" "	100†
Crow's Nest, near Tanpo	" "	50
Principal geyser at Orakeikorako	" "	30
Principal geyser on White Island	" "	100
Te Tarata, at Rotomahana	" "	50
Excelsior	Yellowstone National Park.	300
Giantess	" " "	250
Bee-Hive	" " "	219
Grand	" " "	200
Castle	" " "	200
Giant	" " "	200
Old Faithful	" " "	150
Union	" " "	114
Comet	" " "	100
Great Fountain	" " "	100
Steamboat-Vent	" " "	100
Riverside	" " "	80
Fan Geyser	" " "	75
Oblique	" " "	75
Pelican Creek mud-volcano	" " "	75
Solitary	" " "	70
Grotto Geyser	" " "	60
Fountain	" " "	50
Cliff Geyser	" " "	50‡
Surprise Geyser	" " "	30‡

This list might easily be increased, but it includes all the principal geysers. The bulk of the water in the New Zealand springs is so great that in most cases the columns during eruption do not attain great heights.

* Three hundred and sixty feet is mentioned by Olafson and Povelson, but is probably an estimate.

† A height of two hundred feet has also been recorded for one of the New Zealand geysers.

‡ These are two new geysers discovered in 1883 by Mr. Arnold Hagues, division of the United States Geological Survey.

One point which attracts attention, when the maps of these three regions are compared, is, that in each the hot springs appear to be associated with lakes. In Iceland there are six, in New Zealand fifteen, and in the Yellowstone Park four. All are of considerable size—Lake Taupo, in New Zealand, is twenty-five miles long by twenty wide; Yellowstone Lake measures twenty miles in length, by an average width of about eight miles. In Iceland, Hvitarvatn is nearly ten miles by eighteen; and Thingvallavatn has a length of about twenty miles, and a greatest width of ten or twelve miles. It is interesting in this connection to note that the Thibet geysers occur near a lake. Another point of resemblance is in the character of the deposits, which are alike in appearance, structure, and chemical composition, with the exception, perhaps, of some of the minor constituents. Silica is the predominant element in them, and is derived from the prevailing rocks. In the following table are some comparisons on these points:

LOCALITY.	Grains of silica to a gallon of water.	Percentage of silica in deposits from waters.	Character of rocks.	Percentage of silica in rocks.
Iceland	21·70 to 37·80	84·43 to 98·00	Palagonite and phonolite	41·28 to 72·3
New Zealand	11·48 to 43·95	77·35 to 94·20	Rhyolite and trachytes	70·0
Yellowstone Park	7·84 to 53·76	73·00 to 92·64	Obsidian and quartz-trachytes	64·60 to 77·90

The waters of New Zealand contain a much larger percentage of sodium chloride (common salt) than is found in those of the Yellowstone Park, or in the springs of Iceland.

The springs and geysers of New Zealand can be grouped in three parallel lines, and a similar linear arrangement is seen in the Yellowstone Park, and appears to be analogous to the linear arrangement so frequently noted in the case of volcanoes.

The plateau upon which the Iceland geysers is situated is surrounded on three sides with glaciers. In the Yellowstone Park, glaciers are things of the past; to-day only the erratic bowlders and scratches in the Yellowstone Valley testify to their former presence. In New Zealand the atmosphere is humid, and favorable to a growth of vegetation not found in either of the other regions. In New Zealand there are springs of greater size than those of either Iceland or the Yellowstone Park. In neither of the latter is there a hot lake like Rotomahoma, which is a mile wide by a mile and a quarter in length, and has an average temperature of 78° Fahr. The largest springs at present in the park are the Grand Prismatic spring, measuring two hundred and fifty by three hundred and fifty feet, and the small hot lake in the Lower Firehole Basin, which is one thousand feet long by seven hundred and fifty feet in width. In the past, however, the whole Lower

Basin was covered by a lake, which possibly may have been a hot lake. In our American region, siliceous cones surmounting broad sloping mounds seem to predominate. Although New Zealand has a number of cones or chimneys, the large basins are more numerous. The pool of Te Tarata measures eighty by sixty feet, and the basin of Otakapuarangi is fifty feet in diameter. The springs in Iceland are comparatively small, as a rule, and chimney-like forms are not numerous.

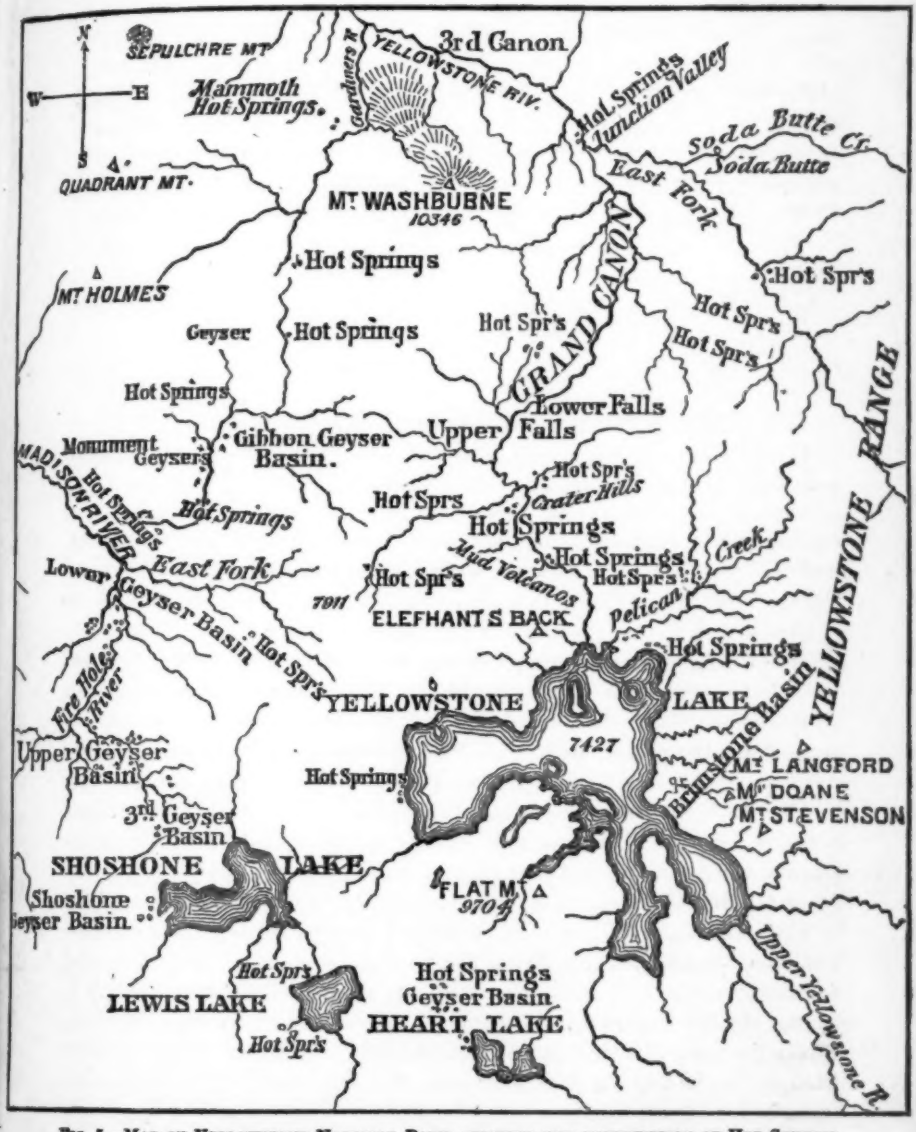


FIG. 5.—MAP OF YELLOWSTONE NATIONAL PARK, SHOWING THE DISTRIBUTION OF HOT SPRINGS AND GEYSERS. (Scale, ten miles to the inch.)

At Reikum the geysers have no deposits, and the "Great Geyser" at Haukadal is situated on the summit of a broad and rather gently sloping mound. Some of these differences will be rendered more apparent when placed in a tabular form:

NAME OF GEYSER.	Location.	Size at top.	Size at base.	Height of cone.
Great Geyser	Iceland	56 feet diameter	101 yards by 75 yards	12 feet.
Waikite	New Zealand		100 feet diameter	15 feet.
Crow's Nest	" "	6 feet diameter.	20 feet diameter	6 or 7 feet.
Pohutu	" "			20 feet.
Union	Yellowstone Park		18 feet circumference.	3 feet.
Flat Cone	" "	55 feet diameter		20 feet.
Steep Cone	" "	55 feet diameter		25 feet.
Bee-Hive	" "	3 feet × 4 feet.	20 feet circumference.	3 feet.
Giant	" "	8 feet diameter.	24 × 25 feet.	10 feet.
Old Faithful	" "	20 by 54 feet.	145 × 215 feet.	11 feet.
Castle	" "	20 feet diameter	120 feet circumference.	12 feet.
White Dome	" "			25 feet.

The Flat and Steep cones have on their summits springs or basins of eight or nine feet diameter, and rims eight or nine inches in height. The cone of the Giant rises from a platform that is four feet high, and has a circumference of three hundred and forty-two yards. The Castle is on a platform that measures seventy-five by one hundred feet, and is three feet high, and the entire mass (platform and cone) is on the summit of a mound that is composed of deposits forty feet in thickness and covers three and a half acres.

It is difficult, and perhaps impossible, to say with certainty what the relative age of these three regions is; still, there are several reasons which seem to indicate that Iceland is the youngest and the Yellowstone Park the oldest, with New Zealand occupying the intermediate position. The first reason is based on a comparison of the volcanic condition of the three regions. Iceland is still in a state of volcanic activity. It has had eruptions as late as 1860 and 1875. There are twenty volcanoes on the island, and Hecla, which is only forty miles from the Haukadal geysers, has had twenty-two eruptions since 1004 or 1005, the date of the earliest record concerning it. In New Zealand the volcanoes adjacent to the geyser areas have sunk into the solfataric stage, and the natives have no traditions of any activity in them. In the Yellowstone National Park it is hard to say positively where the ancient volcanoes stand, although Mount Washburn has been thought to be a volcanic crater, and recently Mr. Arnold Hague has stated that Mount Sheridan may be a crater much modified by glacial action.

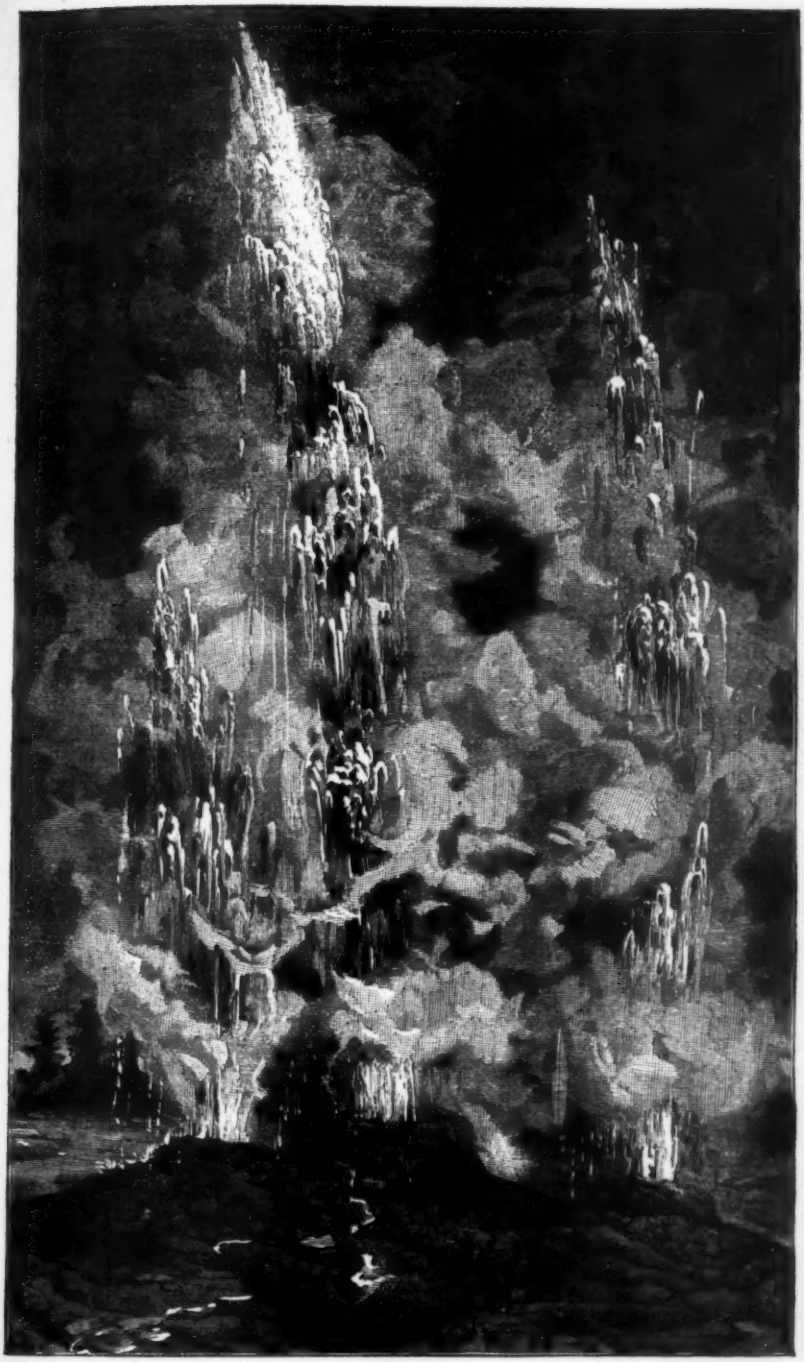


FIG. 6.—ERUPTION OF THE UNION GEYSER IN THE YELLOWSTONE NATIONAL PARK, AUGUST, 1878.

Secondly, when the deposits are compared, we find, as just stated, that the chimney-like form is most prominent in the Yellowstone region, while New Zealand, in that respect also, is intermediate between the park and Iceland. This more chimney-like form in the Yellowstone geysers has been explained by the statement that they contain more silica in solution, but, as already stated in the analysis already made, the percentage is usually smaller; the one exception is in a spring containing 53·76 grains of silica to the gallon of water, and it is a spring that has no conical mound. It has also been suggested that the dry air of our region may have some effect in this direction. We have no data at hand on this point; but the simpler and, to our mind, more reasonable cause is the greater age of our American region. Many of our geysers are secondary in their origin. Thus Old Faithful is a geyser that has broken out on the summit of a mound that had gradually closed up and become extinct. We can not compare the actual thicknesses of the sediments or depositions of the three regions, and, even if we could, the comparison would be apt to mislead us, as the rate of deposition in each region and among individual springs must be variable. A great antiquity, however, can certainly be accorded to all three of them. I will conclude these comparisons with a table of their elevations, including with them some of the other localities mentioned in this article:

	Elevation in feet above sea-level.
Savu Savu, in Feejee Islands	9
Hankadal geysers in Iceland	400
New Zealand geysers	1,000 to 1,300
Boiling Lake of Dominica, West Indies	2,400
Geysers of Yellowstone National Park	6,000 to 8,000
Geyser-region of Thibet	15,000 to 16,000

REPARATION TO INNOCENT CONVICTS.

By Dr. HEINRICH JAQUES,
OF THE AUSTRIAN CHAMBER OF DEPUTIES.

LEGISLATIVE problems are, like books, subject to vicissitudes. Solutions of the particular questions involved in single cases may seem adequate to satisfy deeply-felt wants of the public; yet it may happen that the attention of the latter is—to the scorn of the previous scientific work of years—first suddenly called to the problems by some unexpected, exciting event. It may equally well happen that a single sensational event may bring into current discussion some legislative question hitherto wholly unconsidered by science. The interest of all students is then turned for a short time to this point; its discussion occupies the saloons, fills the columns of the jour-

nals, and is echoed from the chairs of the learned ; but, after a brief period of agitation, the current interest in the subject declines, other events awaken sympathy or antipathy, and the want which the solution of the question seemed destined to meet, appears to have sunk into abeyance. A third condition is also possible and not rare ; it is that science and investigation—even bee-busy German science and investigation—may for years overlook the speculative problem and the real need.

The subject which now engages our attention, and the collateral one of indemnification for unjust or unjustified arrests, have not been spared fatalities of this kind. Under the passionate excitement aroused by the judicial murder of Jean Calas, in France, to which Voltaire gave a world-wide notoriety, public attention was turned with feverish anxiety to the question of indemnifying persons who had suffered under judicial sentence for offenses of which they had been found to be innocent, although the subject had never yet been made a matter of scientific consideration. The Academy of Châlons-sur-Marne made its celebrated offer of prizes for the solution of the question. The subject had a place in the memorable portfolio of the deputies to the States-General of 1789 ; and Louis XVI himself and his statesmen, a Necker and a Pastoret, had it on their programmes. Excessively crude and ill-considered attempts were made to solve it. Two of the prize-writers, Brissot de Warville and Philippon de la Madeleine, proposed decorations, especial rewards, and national honors for persons who had suffered under unjust condemnation, as if the bearing of a wrong and the rendering of a service stood on the same level ; as if the award of distinctions and elevation in rank could be made adequate equivalents for injuries inflicted by the mistakes of the state's agents. The visionary mood of the French people subsided, the excitement passed away ; and, although the question has never since been lost sight of in the criminal literature of the country, it has not yet been solved. Napoleon III of his own initiative issued pardons in several cases in which no right of appeal had been recognized in legislation. In Italy, a mark was made by Filangieri's efforts to introduce reforms, and legislative recognition of the right to indemnity was secured for the first time in the laws of Leopold II of Tuscany, and of Naples ; but the question was overlooked in the codification of the laws of the new kingdom, and the noble efforts of Carrara and Lucchini to secure consideration of it have remained to this day without practical result. In England, except for Jeremy Bentham, juridical literature is, so far as we know, silent on the subject. Those acts of Parliament which have awarded indemnities in cases of peculiar hardship, as in those of the German preacher Hessel and of Bewicke, have advisedly left out of sight the point of principle, which Lord Grey warned his countrymen was entirely sentimental and unapproachable. The cantonal legislation of Switzerland, which Geyer has recently elucidated in a

number of valuable expositions, is, in respect to our question, far in advance of that of the whole continent. In Germany, Heinze brought the problem in its wider aspects under discussion about ten years ago, and the German *Juristentag* began a searching investigation of it. But so remote was the subject then for the otherwise far-sighted legal world of Germany, that the *Juristentag* had to speak three times upon it, at Hanover, Nuremberg, and Salzburg, before it could arrive at a *communis opinio*. This ten years' work would have gone without result, had not a number of striking cases of unjust condemnation recently grieved the public sense of right, led to the introduction of motions in the German Reichstag and the Austrian Reichsrath, and called out a considerable literature of pamphlets and essays by Geyer, Jaques, Schwarze, Lilienthal, List, Kronecker, Gernerth, Bar, Bähr, Jacobi, and the anonymous author of the admirable little treatise, "Gerichtsaal." If, on the other hand, we review the German literature—including discussions of principles and text-books—on criminal process up to the papers that were prepared for the *Juristentag* of 1874, we shall find it wholly silent with respect to our question. This silence is easily understood, in view of what we have said. For the monographic division and subdivision to which legal science, after premature and futile efforts to give it philosophical comprehension, was subjected, with the object of sounding it in detail and mastering the concrete material, involved the laying aside of those problems which had to be solved rather by a simultaneous and uniform review than by any special legal study. To this class of problems belongs our question, which appears to partake at once of the nature of public and private right; to it, to cite a pair of related examples, belong the testing of the constitutionality of laws by the courts, which enters at the same time into the administrative and the judicial domain; and the question of the distinctions between civil and criminal injuries, the scientific solution of which is deduced from both private and criminal law. To it belongs also the question of the responsibility of the state for the faults of its officers, the solution of which again presumes a weighing of factors of private and public law, and this solution science has not until very recently troubled itself to advance.

These changes of aspect and alternatives, by reason of which the cause of reproach exists, that, except in Switzerland, the right of innocent convicts to indemnification has not till the present time received legislative recognition in any European state, have their deeper causes in closest connection with the course of civilizational and political development. So long as the right of the whole public was embodied in the absolute lord's will—so long as the principle prevailed of that *lex regia* transmitted from the Roman law which said, "*Princeps legibus solutus est*"—so long could there not be the remotest suggestion of the right to an indemnity based upon the fact of an unjust condemnation, or of an appeal by the individual against the state. How could a claim

be established against the state, which could not offend, or against its agents, who as such could do no wrong? Even in a much later stage of development, at the epoch when the germs of the modern legal state began to strike root in the public consciousness—at the epoch when there no longer existed any hesitation in affirming that the state could justly carry out its action toward individuals only according to constitutional and legal forms, and that, on the other hand, the individual must be given valid security and effective protection in his constitutional rights and liberties—even at this epoch the ground was not prepared for the admission of claims for damages in cases of injurious misjudgments by the officers of justice. It could indeed be remarked on this point that the state organs could injure and wrong the individual if they designedly or carelessly failed to regard constitutional rules as toward him. But if there could be in this case consideration of claims for damages, did they not have to rest upon two principles that stood in inseparable connection with the traditional categories of the Roman civil law, which has prevailed even in public life until very recently? First, upon the fact that a wrong, of design or negligence, is in question; and, second, upon the other fact that the injured person has to look for the bearer of the responsibility in the matter, not to the state, a juristic impersonation incapable of wrong, but to the individual author of the injury himself, in the present case to the judge, who has not fully discharged his official duty in the particular case, but has rather violated it. Then arose the further advanced idea, only corresponding with the gradual growth of strength in the civic feeling and with the more deep-reaching demands of freedom, that the state itself ought to make amends for injuries to civil rights by its officers, and that this duty of indemnification was imposed upon it, when, although still only objectively infringing upon the sphere of individual rights, it should be found doing wrong and inflicting injury, and that independently of and wholly uninfluenced by the consideration of whether or not a subjective injury existed in consequence of its act.

Yet another most important advance had to be made to give full clearness to the position in public law of the individual as toward the state, and sharply to describe the circle of competence of the public as well as of individuals toward one another. It was to secure an acknowledgment resting upon economical and social as well as upon ethical principles, that all the burdens that are laid upon individuals must be laid with perfect impartiality; and that if the state would be a law-regulated state, a kingdom of justice in the true sense of the word, it should not oblige any individual to make a greater sacrifice for it than all the others.

Not till this principle was recognized was a solid basis gained for the legal right of an innocent convict to demand an indemnity from the state. It must now be plain to every one, and as clear as the sun-

light, that the same rule should prevail with respect to the burden of justice which the state imposes upon individuals as with respect to the burden of taxation or of military service. As the state exacts a universal military obligation which no individual has a right to evade, so, inversely, the individual who enjoys the knowledge of his own innocence has the right to require that the law, to which every one without exception has to submit unconditionally without resistance and without objection, shall commit no offense toward him. If, however, by a casual concatenation of circumstances, or through erroneous suspicions, or by means of false evidence, more suffering or a greater sacrifice is imposed upon one individual than all the others have to bear, it becomes the unavoidable obligation of the state to make amends to him for the excessive burden he has to carry. The duty is an obligation in the strongest sense of the word, and not in the remotest degree a mere matter of equity or of humanity or of favor. For why does this individual have, at the price of his freedom, his honor, his social position, his power to make money, his health and ability to work, of pain and care, and perhaps of misery to his family, to appear and make a sacrifice of himself that the judicial department of the state may exercise its function? Why must he suffer for the mistakes, even if they are unavoidable mistakes, of the state organs? If any one is assessed too highly by some mistake in taxation, even though the error may be in fact pardonable and perhaps unavoidable, does not the financial department consider itself obliged to return to him the whole amount of the excess of the levy, with interest? And if another person has been obliged without any real ground of justice to make a gratuitous sacrifice of his best goods to the judicial administration of the state, is not the state unavoidably pledged to make to him as adequate a reparation for the wrong as is possible? All the analogies of private law, which have been adduced in rebuttal of the state's obligation, fail in the application. The maxim "*qui suo jure utiter, neminem lædit*" ("he who exercises his own right is responsible for no one's injury") does not apply, for the prosecuting state can exercise *suum jure* (its right) only against one who has been delinquent, but no right, rather a wrong, toward a guiltless person. Inapplicable also is the maxim, "*casus nocet domino*" ("damage from accident falls upon the lord"), for if by a false generalization the error of judicial organs is designated as a *casus* (an accident), as *force majeure* (superior force), the *dominus* (or lord), upon whom the burden of the *casus* (or accident) follows, is no other than the state itself. Futile and confusing to clear judgment is also the introduction of other apparently closer-lying analogies of private law, as, for example, of the right of condemnation for railroad and mining enterprises, insurance against violence, and the like. For the legal claim we are speaking of here rests on a basis of public right, on the just limitation of the right and duty of the state as the incorporation of the whole public

as toward the individual, and *vice versa;* it has, besides, its own independent bases, and the other cases are essentially not competent to sustain it.

Respecting the provisions of a law embodying the principle we have been trying to elucidate, but little more can be said than to refer to the bill which has been approved by the Austrian Chamber of Deputies, and whose passage in the Upper Legislative House is anticipated. The easiest accessibility to the courts for the parties, an obligatory stipulation for the gratuitous representation of poor suitors in establishing their claim, an official preliminary investigation, public oral pleadings according to the rules of civil process, the free examination of witnesses, the designation of the amount of indemnity after an open judicial estimation, inquiry into every kind of injury that may have been suffered, and a system of procedure corresponding with these conditions, are obvious points. To these may be added the lapse of the privilege of making the claim after a properly defined interval (one year in the Austrian bill), and in cases where the condemned person has voluntarily filled out his sentence. Extreme care should, however, be taken to give a precise definition to the latter limitation; for it would be wholly unjustifiable to punish the thoughtlessness or ordinary negligence of an uneducated or imperfectly informed person, in failing to produce the evidence in his favor, with the loss of the right of appeal. But gross negligence may be considered in concrete cases to have been designed.

We have thought it proper to limit our discussion in this place to the question of the indemnification of persons who have been unjustly condemned, and have advisedly left out of view the question, closely connected with it in principle, of damages to those who have been subjected to causeless prosecutions. It is well to be satisfied for the time with securing the more important object as a beginning, without imperiling it by complicating it with other conditions. The principle of the matter is carried with the first part, while the second part of our problem may be left to mature itself and pass its course of scientific discussion. In the mean time we, who have labored for ten years in this cause, will regard the result we expect soon to obtain as only a step—as an installment—and will be encouraged by our success to strive for the attainment of the other object.—*Translated for the Popular Science Monthly from the Deutsche Rundschau.*

THE CHEMISTRY OF COOKERY.

By W. MATTIEU WILLIAMS.

XXXII.

SINCE the publication of my last paper, I have been told, by a lady to whom the readers of "Knowledge" are much indebted, that in the fatherland of potatoes, as well as in their adopted country, they are always boiled or steamed in their jackets; that American cooks, like those of Ireland, would consider it an outrage to cut off the protecting skin of the potato before cooking it; that they are more commonly mashed there than here, and that the mashing is done by rapidly removing the skins, throwing the stripped potato into a supplementary saucepan or other vessel, in which they may be kept hot until the preparation is completed.

Returning to the subject at the point where I left, it I must endeavor to describe the effect of cooking on gluten. It is usually described as "partly soluble in hot water." My own examination of this substance suggests that "partially soluble" is a better description than "partly soluble" (Miller) or "very slightly soluble" (Lehmann). This difference is not merely a verbal quibble, but very real and practical in reference to the *rationale* of its cookery. A partly soluble substance is one which is composed of soluble and also of insoluble constituents, which, as already stated, is strictly the case with gluten in reference to the solvent action of hot alcohol. A very slightly soluble substance is one that dissolves completely but demands a very large quantity of the solvent. I find that the action of hot water on gluten, as applied in cookery, is to effect what may be described as a partial solution, that is, effecting a loosening of the bonds of solidity, but not going so far as to render it completely fluid.

It appears to be a sort of hydration similar to that which is effected by hot water on starch, but less decided.

To illustrate this, wash some flour in cold water so as to separate the gluten in the manner described in No. 29; then boil some flour as in making ordinary bill-sticker's paste, and wash this in cold water. The gluten will come out with difficulty, and when separated will be softer and less tenacious than the cold-washed specimen. This difference remains until some of the water it contains is driven out, for which reason I regard it as hydrated, though I am not prepared to say that the hydration is of a truly chemical character, not a definite compound of gluten and water, but rather a mechanical combination—a loosening of solidity by a molecular intermingling of water.

The importance of this in the cookery of grain-food is very great, as anybody who aspires to the honor of becoming a martyr to science may prove by simply making a meal on raw wheat, masticating the

grains until reduced to small pills of gluten, and then swallowing these. Mild indigestion or acute spasms will follow, according to the quantity taken and the digestive energies of the experimenter. Raw flour will act similarly but less decidedly.

Bread-making is the most important, as well as a typical example, of the cookery of grain-food. The grinding of the grain is the first process of such cookery; it vastly increases the area exposed to the subsequent actions.

The next stage is that of surrounding each grain of the flour with a thin film of water. This is done in making the dough by careful admixture of a modicum of water and kneading in order to squeeze the water well between all the particles. The effect of insufficient enveloping in water is sometimes seen in a loaf containing a white powdery kernel of unmixed flour.

If nothing more than this were done, and such simple dough were baked, the starch-granules would be duly broken up and hydrated, the gluten also hydrated, but, at the same time, the particles of flour would be so cemented together as to form a mass so hard and tough when baked that no ordinary human teeth could crush it. Among all our modern triumphs of applied science none can be named that is more refined and elegant than the old device by which this difficulty is overcome in the every-day business of making bread. Who invented it, and when, I do not know, but perhaps Mr. Clodd can tell us. Its discovery was certainly very far anterior to any knowledge of the chemical principles involved in its application.

The problem has a very difficult aspect. Here are millions of particles, each of which has to be moistened on its surface, but each when thus moistened becomes remarkably adhesive, and therefore sticks fast to all its surrounding neighbors. We require, without suppressing this adhesiveness, to interpose a barrier that shall sunder these millions of particles from each other so delicately as neither to separate them completely, nor allow them to completely adhere.

It is evident that if the operation that supplies each particle with its film of moisture can simultaneously supply it with a partial atmosphere of gaseous matter, the difficult and delicate problem will be effectively solved. It is thus solved in making bread.

As already explained, the seed which is broken up into flour contains diastase as well as starch, and this diastase, when aided by moisture and moderate warmth, converts the starch into dextrine and sugar. This action commences when the dough is made, and this alone would only increase the adhesiveness of the mass, if it went no further; but the sugar thus produced may, by the aid of a suitable ferment, be converted into alcohol. As the composition of alcohol corresponds to that of sugar, minus carbonic acid, the evolution of carbonic-acid gas is an essential part of this conversion.

With these facts before us, their practical application in bread-

making is easily understood. To the water with which the flour is to be moistened some yeast is added, and the yeast-cells, which are very much smaller than the grains of flour, are diffused throughout the water. The flour is moistened with this liquid, which only demands a temperature of about 70° Fahr. to act with considerable energy on every granule of flour that it touches. Instead, then, of the passive, lumpy, tenacious dough produced by moistening the flour with mere water, a lively "sponge," as the baker calls it, is produced, which "rises" or grows in bulk by the evolution and interposition of millions of invisibly small bubbles of gas. This sponge is mixed with more flour and water, and kneaded and kneaded again to effect a complete and equal diffusion of the gas-bubbles, and finally the porous mass of dough is placed in an oven previously raised to a temperature of about 450°.

The baker's old-fashioned method of testing the temperature of his oven is instructive. He throws flour on the floor. If it blackens without taking fire, the heat is considered sufficient. It might be supposed that this is too high a temperature, as the object is to cook the flour, not to burn it. But we must remember that the flour which has been prepared for baking is mixed with water, and the evaporation of this water will materially lower the temperature of the dough itself. Besides this, we must bear in mind that another object is to be attained. A hard shell or crust has to be formed, which will so incase and support the lump of dough as to prevent it from subsiding when the further evolution of carbonic-acid gas shall cease, which will be the case some time before the cooking of the mass is completed. It will happen when the temperature reaches the point at which the yeast-cells can no longer germinate, which temperature is considerably below the boiling-point of water.

In spite of this high outside temperature, that of the inner part of the loaf is kept down a little above 212° by the evaporation of the water contained in the bread; the escape of this vapor and the expansion of the carbonic-acid bubbles by heat increasing the porosity of the loaf.

The outside being heated considerably above the temperature of the inner part, this variation produces the differences between the crust and the crumb. The action of the high temperature in directly converting some of the starch into dextrin will be understood from what I have already stated, and also the partial conversion of this dextrin into caramel, which was described in Nos. 13 and 14 of this series. Thus we have in the crust an excess of dextrin as compared with the crumb, and the addition of a variable quantity of caramel. In lightly baked bread, with a crust of uniform pale-yellowish color, the conversion of the dextrin into caramel has barely commenced, and the gummy character of the dextrin coating is well displayed. Some such bread, especially the long staves of life common in France, ap-

pear as though they had been varnished, and their crust is partially soluble in water.

This explains the apparent paradox that hard crust, or dry toast, is more easily digested than the soft crumb of bread; the cookery of the crumb not having been carried beyond the mere hydration of the gluten and the starch, and such degree of dextrin formation as was due to the action of the diastase of the grain during the preliminary period of "rising."

Everybody has, of course, heard of "aërated bread," and most have tasted it. Several methods have been devised, some patented, for effecting an evolution of gas in the dough without having recourse to the fermentation above described. One of these is that of adding a little hydrochloric acid to the water used in moistening the flour, and mixing bicarbonate of soda in powder with the flour (to every four pounds of flour one half ounce bicarbonate, and four and a half fluid drachms of hydrochloric acid of 1·16 specific gravity). These combine and form sodium chloride, common salt, with evolution of carbonic acid. The salt thus formed takes the place of that usually added in ordinary bread-making, and the carbonic-acid gas evolved acts like that given off in fermentation; but the rapidity of the action of the acid and carbonate presents a difficulty. The bread must be quickly made, as the action is soon completed. It does not go on steadily increasing and stopping just at the right moment, as in the case of fermentation.

I remember the first introduction of this about half a century ago, and the anticipations which accompanied it. London was agitated by the bread-reform movement, and bakers were alarmed. A large establishment was opened in Oxford Street, and much amusement created by an opposition placard display in some of the neighboring bakers' shops, "Bread sold here with the gin in it." This, of course, was fallacious, as the alcohol produced by the panary fermentation is driven off by the heat of the oven. Other methods similar in principle have been adopted, such as adding ammonia carbonate with the soda carbonate. The ammonia salt is volatile itself, besides evolving carbonic acid by its union with the acid.

In spite of the great amount of ingenuity expended upon the manufacture of such unfermented bread and the efforts to bring it into use, but little progress has been made. The general verdict appears to be that the unfermented bread is not so "sweet," that it lacks some element of flavor, is "chippy" or tasteless as compared with good old-fashioned wheaten bread, free from alum or other adulteration. My theory of this difference is that it is due to the absence of those changes which take place while the sponge or dough is rising, when, if I am right, the diastase of the grain is operating, as in germination, to produce a certain quantity of dextrin and sugar, and possibly acting also on the gluten. Deficiency of dextrin is, I think, the

chief cause of the chippy character of aërated bread. It must be remembered that this stage is protracted over several hours, during which the temperature most favorable to germination is steadily maintained. Other and very interesting phenomena connected with bread-making will be treated in my next.

XXXIII.

The practical importance of the fermentation described in my last is strikingly shown by the fact that, in the course of sponge-rising, dough-rising, and baking, a loaf becomes about four times as large as the original mixture of flour, water, etc., of which it was made; or, otherwise stated, an ordinary loaf is made up of one part of solid bread to more than three parts of air-bubbles or pores. French rolls, and some other kinds of fancy bread, are still more gaseous.

So far I have only named the flour, water, salt, and yeast. These, with a little sugar or milk added according to taste and custom, are the ingredients of home-made bread, but "baker's bread" is commonly, though not necessarily, somewhat more complex. There is the material technically known as "fruit," and another which bears the equivocal name of "stuff," or "rocky." The fruit are potatoes. The quantity of these prescribed in Knight's "Guide to Trade" is one peck to the sack of flour. This proportion is so small (about three per cent by weight) that, if not exceeded, it can not be regarded as a fraudulent adulteration, for the additional cost involved in the boiling, skinning, and general preparing of the small addition exceeds the saving in the price of raw material. The fruit, therefore, is not added merely because it is cheaper than flour, as many people suppose.

The instructions concerning its use given in the work above named clearly indicate that the potato-flour is used to assist fermentation. These instructions prescibe that the peck of potatoes shall be boiled in their skins, mashed in the "seasoning-tub," then mixed with two or three quarts of water, the same quantity of patent yeast, and three or four pounds of flour. The mixture is left to stand for six or twelve hours, when it will have become what is called a *ferment*. After straining through a sieve, to separate the skins of the fruit, it is mixed with the sack of flour, water, etc.

It is evident from this that it would not pay to add such a quantity in such a manner as a mere adulterant. The baker uses it for improving the bread, from his point of view.

The *stuff* or *rocky* consists, according to Tomlinson, of one part of alum to three parts of common salt. The same authority tells us that the bakers buy this at 2*d.* per packet, containing one pound in each, and that they believe it to be ground alum. They buy it thus for immediate use, being subject to a heavy fine if they keep alum on the premises. The quantity of the mixture ordinarily used is eight ounces

to each sack of flour weighing two hundred and eighty pounds, so that the proportion of alum is but two ounces to two hundred and eighty pounds. As one sack of flour is (with water) made into eighty loaves weighing four pounds each, the quantity of alum in one pound of bread amounts to $\frac{1}{160}$ of an ounce.

The *rationale* of the action of this small quantity of alum is still a chemical puzzle. That it has an appreciable effect in improving the *appearance* of the bread is unquestionable, and it may actually improve the quality of bread made from inferior flour.

One of the baker's technical tests of quality is the manner in which the loaves of a batch separate from each other. That they should break evenly and present a somewhat silky rather than a lumpy fracture, is a matter of trade estimation. When the fracture is rough and lumpy, one loaf pulling away some of the just belongings of its neighbor, the feelings of the orthodox baker are much wounded. The alum is said to prevent this impropriety, while an excess of salt aggravates it.

It appears to be a fact that this small quantity of alum whitens the bread. In this, as in so many other cases of adulteration, there are two guilty parties—the buyer who demands impossible or unnatural appearances, and the manufacturer or vender who supplies the foolish demand. The judging of bread by its whiteness is a mistake which has led to much mischief, against which the recent agitation for "whole meal" is, I think, an extreme reaction.

If the husk, which is demanded by the whole-meal agitators, were as digestible as the inner flour, they would unquestionably be right, but it is easy to show that it is not, and that in some cases the passage of the undigested particles may produce mischievous irritation in the intestinal canal. My own opinion on this subject (it still remains in the region of opinion rather than of science) is that a middle course is the right one, viz., that bread should be made of moderately dressed or "seconds" flour rather than overdressed "firsts," or undressed "thirds," i. e., unsifted whole-meal flour.

Such seconds flour does not fairly produce white bread, and consumers are unwise in demanding whiteness. In my household we make our own bread, but occasionally, when the demand exceeds ordinary supply, a loaf or two is bought from the baker. I find that, with corresponding or identical flour, the baker's bread is whiter than the home-made, and correspondingly inferior. I may say, colorless in flavor, it lacks the characteristic of wheaten sweetness. There are, however, exceptions to this, as certain bakers are now doing a great business in supplying what they call "home-made" or "farm-house" bread. It is darker in color than ordinary bread, but is sold nevertheless at a higher price, and I find that it has the flavor of the bread made in my own kitchen. When their customers become more intelligent, all the bakers will doubtless cease to incur the expense of buy-

ing packets of "stuff" or "rocky," or any other bleaching abomination.

Liebig asserts that in certain cases the use of lime-water improves the quality of bread. Tomlinson says that, "in the time of bad harvests, when the wheat is damaged, the flour may be considerably improved, without any injurious result whatever, by the addition of from twenty to forty grains of carbonate of magnesia to every pound of flour." It is also stated that chalk has been used for the same purpose. These would all act in nearly the same manner by neutralizing any acid that might already exist or be generated in the course of fermentation.

When gluten is kept in a moist state it slowly loses its soft, elastic, and insoluble condition; if kept in water for a few days, it gradually runs down into a turbid, slimy solution, which does not form dough when mixed with starch. The gluten of imperfectly ripened wheat, or of flour or wheat that has been badly kept in the midst of humid surroundings, appears to have fallen partially into this condition, the gluten being an actively hygroscopic substance.

Liebig's experiments show that flour in which the gluten has undergone this partial change may have its original qualities restored by mixing one hundred parts of flour with twenty-six or twenty-seven parts of saturated lime-water and a sufficiency of ordinary water to work it into dough. I suspect that the action of the alum is of a similar kind, though this does not satisfactorily account for the bleaching.

The action of sulphate of copper, which has been used in Belgium and other places for improving the appearance and sponginess of loaves, is still more mysterious than that of alum. Kuhlmann found that a single grain in a four-pound loaf produced a marked alteration in the appearance of the bread. Fortunately, this adulteration, if perpetrated to a mischievous extent, may be easily detected by acidulating the crumb, and then moistening with a solution of ferrocyanide of potassium. The brown color thus produced betrays the presence of copper. The detection of alum is difficult.

I should add that the ancient method of effecting the fermentation of bread, and which I understand is still employed to some extent in France, differs somewhat from the ordinary modern practice described in my last. When flour made into dough is kept for some time moderately warm, it undergoes spontaneous fermentation, formerly described as "panary fermentation," and supposed to be of a different nature from the fermentation which produces yeast.

Dough in this condition is called *leaven*, and when kneaded with fresh flour and water its fermentation is communicated to the whole lump; hence the ancient metaphors. In practice the leaven was obtained by setting aside some of the dough of a previous batch, and adding this when its fermentation reached its maximum activity. One

reason why the modern method has superseded this appears to be that the leaven is liable to proceed onward beyond the first stage of fermentation, or that producing alcohol, and run into the acetous, or vinegar-forming fermentation, producing sour bread. Another reason may be that the potato mixture above described, which is but another kind of leaven, is more effectual and convenient.

Dr. Dauglish's method (patented in 1856, 1857, and 1858) is based on the fact that water under pressure absorbs and holds in solution a large quantity of carbonic-acid gas, which escapes when the pressure is diminished, as in uncorking soda-water, etc. Dr. Dauglish places the flour in a strong, air-tight iron vessel, then forces water saturated with carbonic acid under high pressure into this; kneading-knives mix the dough by their rotation. When the mixture is completed, a trap at the lower part of the globular iron vessel is opened. The pressure of the confined carbonic acid above forces the dough through this in a cylindrical jet or flat ribbon as required, and this squirted cylinder or ribbon is fashioned by suitable cutters, etc., into loaves. The compressed gas expands, and the loaves are smartly baked before the expansive energy of the gas is exhausted.

The difference between new and stale bread is familiar enough, but the nature of the difference is by no means so commonly understood. It is generally supposed to be a simple result of mere drying. That this is not a true explanation may be easily proved by repeating the experiments of Boussingault, who placed a very stale loaf (six days old) in an oven for an hour, during which time it was, of course, being further dried; but, nevertheless, it came out as a new loaf. He found that during the six days, while becoming stale, it only lost one per cent of its weight by drying, and that during the one hour in the oven it lost three and one half per cent in becoming new, and apparently more moist. By using an air-tight case instead of an ordinary oven, he repeated the experiment several times in succession on the same piece of bread, making it alternately stale and new, each time.

For this experiment the oven should be but moderately heated—130° to 150° is sufficient. I am fond of hot rolls for breakfast, and frequently have them *à la Boussingault*, by treating stale bread-crusts in this manner. My wife tells me that when the crusts have been long neglected, and are thin, the Boussingault hot rolls are improved by dipping the crust in water before putting it into the oven. This is not necessary in experimenting with a whole loaf or a thick piece of stale bread.

The crumb of bread, whether new or stale, contains about forty-five per cent of water. Miller says, "The difference in properties between the two depends simply upon difference in molecular arrangement."

This "molecular arrangement" is the customary modern method of explaining a multitude of similar physical and chemical problems,

or, as I would rather say, of evading them under the cover of a conventional phrase.

I am making a few experiments which promise to afford an explanation of the changes above described, without invoking the aid of any invisible atoms or molecules, or anything else beyond the reach of our simple senses, and will communicate the results in my next paper.—*Knowledge.*

MY MONKEYS.

By M. J. FISCHER.

I HAVE never bought any trained monkeys, but, in my experiments in domesticating wild ones, have always treated my animals with the greatest care, and chosen moral rather than physical means of discipline. The relations between the monkey and his master ought to be friendly, and, when the first causes for fear and motives to anger have been suppressed, there will remain on the animal's part only feelings of respect. He will recognize his inferiority to man, and will respect him without fear. These lively and nervous animals, abruptly torn from their native wilds, to be shut up and treated in an unnatural manner, preserve in captivity their good-humor and intelligence to a remarkable degree.

The monkeys I have kept have been both of New World and Old World species. The last are the more intelligent.

In April, 1873, I received a young male of *rhesus* (*Macacus erythræus*, or *rhesus*), well tamed, and weighing about three pounds and three quarters, but coming to me with a cold and in a very thin and dejected condition. His hair was lusterless, short, and all off in spots, while his tail was quite bare. He had, although a male, received the name of Molly, and answered to it readily. I did not change it. I gave him a cage large enough for him to turn around in freely, and to afford ample room for all the manifestations of his sanguine and nervous temperament. A few days after he came, I allowed him a brief promenade in the room. Without disturbing anything, he posted himself at a window, whence he could look at the passers-by. His conduct was so rational that I determined to extend his promenade, and shut him up only while I was away. This liberty, the constant intercourse with persons who caressed him as much as he would let them instead of teasing him, the quiet of his surroundings, and the removal of every feared and exciting object, exercised a decisive and favorable influence on his mental and physical development.

His attachment to me was extreme. He was near me all day, and followed me around like a faithful dog. When I hid away from him or shut a door in his face, he would cry and try to open the door with

his hands, succeeding at last by throwing his whole weight upon the latch. In May my house was painted and whitewashed, and a scaffolding was built around it to facilitate the work. The top of the highest timber became Molly's favorite place. It was some four feet above the roof; Molly was accustomed to sun himself upon it, and from it he watched attentively all who passed. He would never move from it as long as he could see me. But, as soon as I set foot out of the grove where I used to work, he would set up a plaintive cry, and slide down the timbers to hunt me up, and would not stop his whining till he had found me, an event which he marked by repeated grunts of joy.

He gave me a proof of the susceptibility of the character of his species the very day he came. Perching himself on my wife's shoulders, he amused himself with disarranging her hair. Tired of this, my wife tried to push him away, at first pleasantly, then roughly. The last movement cost her a bite on the hand, and in return for this she struck Molly sharply on the cheek, when the monkey ran to his cage in great anger. From that day the inclination he had formed toward my wife was turned to a violent hatred, which he continued to manifest till the end of his days. All his affection was turned toward me, and it was really admirable. No dog ever showed so exclusive an attachment to me as this monkey, a fact the more singular because the animal had come from a wild life, and not, like the dog, from trained ancestors. Molly never refused morsels from the hand of other persons than myself; but, accepting the gift from them, he would scratch or bite the hand that offered it.

He was greatly frightened at a gun that I shot off one day at some sparrows. He hid at once in the straw of his cage, and never left it till the gun was hung up again. After that I had only to touch the stock, to make him hide again, when nothing could be seen in the straw, except a pair of sharp eyes watching all my motions. Just a touch of my finger or of a cane upon the cock of the gun was enough to deprive him of all quiet. I used to carry on my watch-chain a little pistol, on which a percussion-cap would make a tolerably loud report. The monkey had not yet found this out, and, sitting on my knees, would amuse itself with licking the silver barrel. One day in his presence I put a percussion-cap on the nipple of the pistol. The monkey observed my movements with great attention, but without seeming disturbed by them. But when the cock, being raised, made two clicks, Molly dropped his eyebrows, while he continued sitting quietly. When the explosion took place, his fright was unbounded. Crying loudly, and full of anguish, he fell from my knees, ran across several rooms, leaped out of the window, clung to a water-pipe, slid down to the street and hid himself in a ditch in a neighboring garden. His nervousness lasted a long while, and I had to take off my watch-chain to appease it. From that day he was in such fear of the little pistol that to take

hold of the chain was enough to make him disappear in the straw. But he very soon learned by experience that the source of the detonation was not in the chain but in the pistol, and could easily distinguish it from the other appendages of the chain, of which he was not afraid at all. Sitting on the straw in his cage, he would attentively watch my movements while I was handling these appendages. The closer my fingers approached the formidable object, the greater became his anxiety, and with his eyes riveted upon the instrument and with tense ears, he would dance continuously in the cage, all ready to go under the straw. He would assure himself beforehand, for greater security, that the cage-door was well shut; and one day, when the bolt had not been pushed in, he leaped out from the cage, which did not seem safe enough for him, and went and hid himself under the bed in the next room. As I gradually removed my hand from the pistol, I would receive chuckles of approbation; and, with his lips pushed forward and the muscles of his ear moving by jerks, he would manifest a very great joy.

The conclusion is forced by these facts, that monkeys by experience become more prudent and more cunning. Carrying experiments of this kind further, I have observed that the monkey can recognize the object of its fear even in a picture, manifesting a faculty which is largely wanting in little children and savages. I one day received an armorer's illustrated catalogue. It had among other objects a drawing of a revolver of the natural size, an arm which the rhesus had never yet seen. I gave the catalogue to my pet, and he, after the manner of many monkeys, began to turn the leaves. But, as soon as he got to the picture of the revolver, he dropped the catalogue, groaned lustily and made faces, and at once ran to hide himself in the straw, which he would not leave till the pamphlet was taken away.

The last fact proves the superiority of simian intelligence over that of the other mammals. I disagree on this point from Perty, who says, "A small number of animals, among which is the elephant, recognize drawings of objects that are familiar to them." I must avow that my investigations on this subject, upon the few elephants living in Europe, have given me negative results. I do not know of any domestic animal that can distinguish a picture. It is useless to show dogs faithful drawings of the dog, or of game; the result is nearly always the same. The animals will smell the paper, examining the substance, not the picture, and, once convinced there is nothing in it to exercise their teeth upon, they resignedly abstain from any more profound investigation. Monkeys, at least Old World monkeys, act differently.

The rhesus, a baboon (*Inuus ecaudatus*), three Java monkeys (*Macacus cynomolgus*), and a *sajou* (*Cebus hypoleucus*) were drawn in crayon for an illustrated magazine in pictures having a striking resemblance to the originals. I gave each monkey his portrait. The rhesus and the Java monkeys recognized the pictures at once, and acted pre-

cisely as if they were before a looking-glass. The rhesus grinned, then laughed, and at last turned his back to the picture, uttering grunts of satisfaction, as if he expected to be scratched. The Java monkeys stared at the picture; with the skin of their foreheads drawn back, their lips pushed out and constantly moving, they regarded it from a distance and close up, to find out what it was. The other species likewise recognized the nature of the pictures, but without exhibiting as strong excitement as the two species mentioned. The least intelligent of the number was the sajou, which, examining the portrait from the head down and moaning, stretched its hand toward it, trying to tear it with his nails. Evidently it did not recognize the portrait either as one of itself or of another monkey, while it took in pictured insects very well, and was frightened at the sight of the painting or drawing of a viper. Notwithstanding these examples, I was careful not to generalize so as to extend to a whole species the faculties of a few individuals belonging to it. Among monkeys, as with man and other animals, there are individuals of extensive and individuals of very limited gifts in the same species. None of the many monkeys could distinguish pictures of landscapes or houses, in respect to which they were precisely like savages.

Only a few dogs give any signs of intelligence before their image in a glass. Some just distinguish it and remain quite indifferent; others growl or bark, but they seldom try to determine whether a second individual really exists. I have remarked the same of cats, and Blanchard's cat in Paris, that dashed furiously at a looking-glass, is a unique example.

The rhesus looked into the mirror with a joyous air, stretched out his ears, drew up the skin of his forehead and his eyebrows, puckered his lips, grinned and laughed, and turned his posterior to the glass. This gesture is general among some kinds of monkeys. I had already described it as a peculiarity of a mandrill, when Darwin, having read my article, sent me a letter on the subject, asking me what significance I attached to it. I answered him that, according to my experiments, the gesture was a mark of simian politeness. Once in position, the monkey expects to be scratched, just as when we extend our hand to another person we expect to receive his. Darwin verified my observation, and compared the gesture with certain forms of salutation among savages, such as those by feeling the belly or rubbing noses. My rhesus, not succeeding in getting scratched by his image, turned around and passed his hand behind the glass to feel for it. I took the opportunity to pinch him sharply behind the glass, when he became very angry, not at me, but at the image. His face turned red, his ears were extended, and his jaws gaped open repeatedly. The gaping was so irresistible that he could not stop it, not even to chew or swallow. It is a sign of great anger and violent nervous disturbance. It occurs very frequently with the *pavions*, almost regularly, and the animal is

often so overcome by its paroxysm that it can neither defend itself nor attack. Another sign of anger is given by shaking violently with the four hands the bars of the cage, the grating, or some support. This habit, born of the forest, is evidently intended to frighten enemies with noise. Molly never failed to exercise it when, after having been teased by any one, he heard him laugh. The cage was fastened to the table, and both were fastened to the wall. As long as the cage was loose, Molly would shake it. As soon as it was fixed, he tried to shake it, and, failing, did not do so again till time and use having worn upon the nails, the cage gained a little play, when he seized his opportunity and the racket was renewed. I then put in a piece of India-rubber to muffle the sound, and the monkey stopped his shaking. He did not care to see the cage move, but to make a noise. This habit is, however, not always a sign of anger. Some monkeys practice it under the influence of *ennui* or impatience, or when they wish to attract attention, and, in the lack of any other resource, the rhesus would hunt up in his straw a dry bread-crust, a nut-shell, a bone, or anything hard that he could strike against his cage-bars.

To express a desire, my monkey utters a prolonged "Oh!" or sounds the interjection in two syllables, with the second a fifth higher than the first. The tone rises according to the intensity of the desire. Thus, when I was talking with another person of the favorite eatables of the rhesus (such as milk, apples, potatoes, and rice), the monkey, although I was not speaking to him, underlined those well-known words with chuckles of approbation, and pushed his *oh's* through his lips, which were puckered out as if he were whistling. His attitude was the same when I gave the order from my room to have his meal brought in. The rhesus would at once fix his eyes on the door by which the anticipated feast was to come in; and this, no matter what might be the time of the day or night. The behavior was, then, not influenced by the periodicity of the want, which determines regular actions with many other animals, and was independent of the person who pronounced the words. I might cite thousands of cases observed on my premises, by hundreds of persons, that prove superabundantly that monkeys fully comprehend the relations of certain words and the objects corresponding to them.

The rhesus knew, besides, the names of all the animals that lived in the same room with him but in different cages—some sixty or seventy in number. If I pronounced the name of any of them, without giving any sign of voice or look, he would put his head through the hole in the cage, and turn it significantly toward the animal in question.

This monkey's fear of snakes was extreme, and extended to everything that had any resemblance to them. The same feeling is common to all monkeys. A very fine mandrill of my pets having a habit of prying about, I found no better way of restricting his investiga-

tions, which were sometimes annoying, than to put snake-skins under the objects I wished him to respect. The device succeeded admirably. It was to the same mandrill I once showed a prospectus of Semper's "Journey to the Philippine Islands," in which there was a picture of a holuthuria. At the unexpected view of this sea-horn, the mandrill made a jump and struck the ground with his hands, while his hair stood out and his body trembled from head to foot. The rhesus gave me a yet more striking example of this horror. I had received a large python, which I had brought into the room every day for a warm bath. After nine days, I had only to call out, "Bring in the serpent," for the monkey to disappear under the straw. Long after the serpent had been restored to health and the baths had been discontinued, the repetition of the order would set Molly a-trembling at any time.

Perty says that dogs are the only animals capable of reading human physiognomy; but one has only to possess monkeys and be acquainted with them to know that they too can read it better than children can. I except New World monkeys, which have little or none of the faculty. I had a little female Java macacus, of an exceedingly pleasant and timid nature. I had only to raise my voice in speaking to her, to arrest all her motions. When I returned into the room, she would follow me with her eyes, trying to read the expression of my face, and endeavoring to gain my sympathy by a low murmuring, going away or coming up to me according to the play of my features. If she saw me smile she would make a sound of gladness, clasp my knees and press against me, with murmuring lips and eyes gazing into mine. But, at the first frown or hard look, the macacus would drop down crying and run away. The rhesus responded in a somewhat similar manner to my expressions.

Monkeys have a passion for cleanliness. Once on your knees, they will pick you from head to foot, not letting a wrinkle escape, and all with the most serious air. My rhesus could not endure badly dressed persons. He was always ready to defend me, and to spring upon any one who would touch me with the tip of his finger. He had no respect for children, but acted as if he took them to be large monkeys, and would sometimes attack them when they were too saucy. Some of the other monkeys, however, seemed to be quite fond of them. The rhesus appreciated the inferiority of my servants to myself, and would become angry at any one of them when I reprimanded him, his anger being modulated according to my tone, and sometimes leading him to acts. He co-operated in all my gestures when I acted as if I were beating a man or a dog, but if it were another monkey that was threatened he took its side. The feeling of compassion is not strange to monkeys. They will defend and protect threatened individuals, sometimes offering their own bodies as a shield. They extend their commiseration to animals of another species. The rhesus became furious

when he saw the ferret, in the course of his training-lessons, biting rats, and, taking him by the tail, bit him to save the rat.

The rhesus slept at first perched on the bars of his cage, but soon learned to accustom himself to easier positions. He could cover himself up with the quilt, and would finish by drawing it over his head with his teeth. He often had lively dreams. I could see him grin, and hear him utter low but distinct sounds of comfort, of desire, and sometimes of fright. In the latter case he would always awake, jump to the highest stick, and cast frightened looks around.

His obedience was complete, and was never wrecked except upon the rock of gluttony. If I left any delicacy on the table, he would never touch it when I was looking on; but, after my back was turned, nothing of it could be found. I could not contend with this fault except by stratagem; but to put a stuffed snake-skin by the side of the coveted object was always enough to secure its protection.

The feeling of the right of property is common to all monkeys. I gave a red quilt to a Java macacus and a blue one to another macacus. Each one was jealous of his own garment, and the least infringement by one on the proprietary rights of the other was followed by a battle.

Perty says that monkeys can untie knots, but can not tie them. Is this a mark of inferiority? Monkeys, like other animals, have for most of their actions a determined object. My rhesus was obliged, to get honey, to open the closet and, to be at liberty, to untie the rope. He did both. But why should he shut the door, or tie the rope again? Do we not have to teach children and boors to shut doors?

Monkeys can estimate weights. I gave the rhesus full eggs and empty shells, between which there was no difference to the eye. At first he bit both alike, but he soon learned to throw the empty shells away without biting them. I continued the egg experiments by filling the egg-shells with iron filings, lead, sawdust, and sand. After several trials, he never could be deceived except by eggs of the same density as normal ones. This faculty is not, however, equally possessed by all monkeys.

It can not be denied that monkeys have some, but a weak, notion of number. My rhesus was accustomed to get a certain number of carrots, or apples, or potatoes, and, if his ration fell short, he would always take notice of the deficiency. If he got only three apples when he was expecting four, he would not move from the grating till the fourth apple was brought him. Music had but little effect upon him; but the sound of a hunting-horn would send him under the straw, and cause him to scratch his ears as he would do when one was driving a nail near him. Nothing delighted him more than to have a lighted cigar or pipe in his mouth. He would fill his cheek-pouches with the smoke and send it out through his nostrils like any expert at the cigarette.

The anecdotes about the propensity of monkeys to imitate man are much exaggerated. They have a physical structure like his, and mental qualities in some respects not wholly dissimilar from his, and naturally make gestures like those of men; and that is the most of truth there is in those stories.

Monkeys have a language, as among themselves, that is easily understood by individuals of the same species. Individuals of different species, if not too far remote, can after a time learn to understand each other; but if the species are very different, like those of the Old and the New World, the effort is tantamount to that of learning a new language, and frequently requires several years. As the thoughts of monkeys are excessively limited in extent and their wants relate solely to food and the struggle for existence, their language is but little varied, and is composed chiefly of vowels pronounced with different intonations and accompanied by different expressions of the figure, the most common of which are laughing and grinning, and which each species performs in its own peculiar fashion. The expressions of anger are also characteristic, and vary with the species.

My rhesus, together with a large mandrill and a *Cynopithecus niger* of unusual size, ate at my table, and received all the dishes that I had. The rhesus preferred roast fowl and roast mutton to all other meats, and also liked eggs, raw or cooked. His weakness for eggs once cost me a considerable sum, which I had to pay to a neighbor for one hundred and fifty eggs of high-bred fowls which my pet had destroyed. He ate all kinds of seeds, and liked much to vary his food. Among vegetables he preferred asparagus, and had a strong appetite for fruits, to gratify which he made my own and my neighbors' orchards suffer.

His ordinary drink was milk and half a glass of Bordeaux, which he took in his hand as a man would have done, without spilling a drop. I sometimes gave him tea, chocolate, cocoa, coffee, beer, and white Tokay wine. He frequently abused the last drink, and learned to go into a room where a bottle of it was kept. He would then get drunk —dead-drunk—like any man, and my servant would find him and call to me to help put him into the cage. But, even in this condition, he never failed to have a degree of respect for me, though he would resist being moved, as the street-toper resists the policeman. Put in the cage, he would sleep off his draught stupidly, and then be sick for two or three days, obstinately refusing to eat anything, but never to drink.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

THE SALT-DEPOSITS OF WESTERN NEW YORK.

By FREDERIC G. MATHER.

WYOMING County, in the State of New York, is bounded on the southeast by the wonderful gorge that has made famous the mighty leaps of the Genesee River at Portage. A few miles to the north is the plateau which holds the crystal waters of Silver Lake; while still farther to the north and west rise the head-waters of Oatka Creek, which flows in a northeasterly direction through the county of Genesee, and empties into the river of that name just before it comes to Rochester. The Oatka was formerly called Allen's Creek, after a resolute pioneer. The valley and the county were named Wyoming, from a striking similarity to the valley in Pennsylvania which once received the murderous visit of the savage, and which has been immortalized in the verse of Campbell. Warsaw, the shire-town of Wyoming, most romantically situated near the source of the creek, was called by the Indians "Chi-nose-heh-geh," or "on the side of the valley." The village of to-day numbers but twenty-five hundred inhabitants, although the region all about has been settled nearly one hundred years, and although a prominent railroad skirts the valley on either edge. All about is a most excellent farming-land, second only to the Genesee Valley. The butter and cheese are of the best quality, and they find a ready sale in Buffalo or in Rochester, either metropolis being less than fifty miles away. This valley, hitherto so peaceful, is now the center of a business activity that bids fair to be permanent, and that will reduce by one the number of staple articles for which the United States has hitherto depended upon foreign countries.

Over forty years ago extensive surveys were made from Oswego to Niagara, and salt-springs were found in many places. In the hollows toward Lake Ontario the brine was discovered in such quantities as to make unnecessary any additional salting of the cattle that were pastured in the vicinity. It was also discovered that salt might be found at the south of this belt, but not without considerable boring. No one, however, suspected that the valley would yield salt as far up as Warsaw. Therefore, when the Vacuum Oil Company, of Rochester, commenced to bore for oil at Wyoming, just north of Warsaw, the enterprise was thought to be only a natural extension of the oil-fields of Pennsylvania, which lie fifty miles or so to the southward. The man who directed the boring had been a boy in the Wyoming Valley, and he had enough faith in the existence of oil to lease the neighboring farms for ninety-nine years, with the agreement that he would put down a test-well; that, if successful, a well should go down on every man's farm; and that the owner of the farm should have one eighth of the product in every case. Oil was not found, but brine came up in sufficient quantities to show that the salt was there. The treasure was

allowed to remain undisturbed until two years ago, when a well was sunk in Warsaw to a depth of thirteen hundred feet, where a bed of salt eighty-five feet thick was encountered. From this bed the Warsaw Salt Company has been drawing one hundred and fifty barrels of brine daily for the past year. Two miles below this is the well of the Crystal Salt Company, which, starting with a daily yield of fifty barrels, has now reached several hundred. On the eastern slope of the valley extensive works have been erected by Dr. Guionlock, who has had thirteen years' experience with the salt product at Goderich, in the Province of Ontario, and who prefers the Warsaw product to the other. Across the valley, on the western slope, is the well of another Warsaw company. In short, there are, within a radius of three miles of Warsaw, seven wells already down and three more in process of digging, the output of which when completed will be three thousand barrels daily, the output at Syracuse being but five thousand barrels daily.

The unexpected treasures found at Warsaw have added hundreds to its population, have increased real estate fifty per cent, and have secured a new railroad, the "Oatka Valley," in addition to the Rochester and Pittsburg, and the New York, Lake Erie and Western, and the Lehigh Valley, which are already there. The newly-laid tracks of the New York, Lackawanna and Western are only a dozen miles away. The hill-sides are covered with hard-wood timber, which can be converted into barrels. With this bright outlook it would not be strange if the people of Warsaw should picture to themselves a future labyrinth of salt-mines that might rival that of Austrian Galicia, with its saline church dedicated to St. Anthony. Even at this stage of the enterprise the men of Warsaw are said to keep one of their number on guard at the arrival of every train, lest some prospector should stray as far down the valley as Wyoming, Pavilion, Covington, or Le Roy, or even over the ridge to Greigsville. If they have their own way, no other spot aside from Warsaw will share in the benefits of the discovery; and from his elevated post on the magnificent soldiers' monument the stone sentinel will gaze defiantly on the surrounding towns. In such a case the poet sang of the sentinel as well as of Kosciusko:

> "Warsaw's last champion from her heights surveyed,
> Wide o'er the fields, a waste of ruin laid."

But are the men of Warsaw to have, what they naturally desire, a monopoly of the new salt production? It is evident that the average depth of the salt-bed thereabout is eighty feet, and that the depth of boring required to reach the bed becomes less as the prospector travels north. This southerly dip has given hopes to the dwellers about Rochester that the bed will be found much nearer the surface at that point—a fact that would lead to cheaper production, even if the thickness of the bed were less. Then, too, the dwellers east and west of the meridian line, upon which are located most of the wells bored thus far, are confident that salt will be found many

miles away from the said line, and they have started "pointers," after the manner of the oil-country, to mark the limits of the territory. The geologists affirm that all the salt of Syracuse, Warsaw, Saginaw, and even of Wisconsin and Iowa, belongs to the Onondaga salt-group, and that it was deposited all over this extensive tract in a chain of land-locked lakes fed by occasional overflows from the ocean, and depositing their saline contents by evaporation. A similar process is now going on at the Runn of Cutch, of which Sir Charles Lyell says: "That successive layers of salt might be thrown down, one upon another, over thousands of square miles in such a region, is undeniable. The supply of water from the ocean would be as inexhaustible as the supply of heat from the sun for its evaporation." This theory will explain why the dip of the salt-strata of Western New York, added to the natural rise of the ground, makes a boring of fifteen hundred feet necessary at Warsaw, while at Salina a depth of only two hundred feet is required.

In this fact of the strata coming nearer the surface to the northward of them lies the danger to the hopes of the people of Warsaw. In many other respects they are warranted in believing that they have a bonanza. The "pointers" that have been already sunk and the unsuccessful experiments that have been made in former years show that the beds of rock-salt do not extend farther north than Caledonia, in Livingston County, nor farther south than Castile, in Wyoming County. The narrow strip within which the beds are confined runs from Onondaga County, on the east, through the counties of Cayuga, Seneca, Yates, Ontario, Livingston, and Wyoming, to Erie on the west.

The claim that the sign "Warsaw salt" represents a superior article appears to be well-founded—the brine having been analyzed with flattering results by Dr. Lattimore, of Rochester, and Dr. Englehart, State chemist, of Syracuse. The latter reports the specific gravity to be 1·205. The analysis of 100 parts is as follows: Sulphate of lime, ·257; chloride of calcium, ·068; chloride of magnesium, ·005; chloride of sodium, 26·300; pure water, 73·370. The exceptionally small proportion of the chlorides of calcium and magnesium will be noted, as well as the large proportion of pure salt which the recent superintendent of the Syracuse salt-springs declares entitles the Warsaw brine to rank as 100 to 66 for the Syracuse brine. An analysis of the manufactured article shows the following results:

	Warsaw salt, No. 1.	Warsaw salt, No. 2.
Soluble matter	0·104	0·013
Moisture	1·500	0·753
Sulphate of lime	1·464	0·955
Chloride of calcium	0·136	0·089
Chloride of magnesium	0 298	0·118
Pure salt	96·498	98·072
Total parts	100·000	100·000

It is stated that the superior strength of the Warsaw brine makes it possible for one ton of coal to produce more salt, by sixty-four cents' worth, than can be produced from the Syracuse brine. This fact, together with the falling off in the Syracuse output, has called marked attention to the Warsaw wells.

The product of salt from the Michigan wells is over 15,000,000 bushels annually, on which the profit is large because the fuel consists of slabs and sawdust, a mere nothing. An eminent authority—Dr. Mitchell—states that there are three sources of the salt-supply in Michigan: 1. In the coal-measures and in the white and porous Parma sandstone, which serves as a reservoir. 2. The "Michigan Salt-Group," which lies between the carboniferous limestone and the sandstones at the base of the carboniferous system. This group consists of various shales, magnesian limestone, and beds of pure gypsum. The material of the reservoir is Napoleon limestone. The depth of boring is 600 to 700 feet, and the total area of the territory is about 17,000 square miles. 3. The "Onondaga" or Salina Salt-Group, which lies 500 feet below the Michigan Salt-Group, and in which alone are found the beds of rock-salt. The most important well is that at Marine City, on the St. Clair River, the total depth being 1,633 feet, and the thickness of the salt-beds 115 feet. The well at Muskegon, on Lake Michigan, is 2,000 feet deep, and the thickness of the salt-beds is 50 feet. Other important wells are operated at Bay City and at Manistee.

Similar beds are found in the Province of Ontario, at Goderich, Huron County. They are in the Salina formation also, the depth averaging about 1,000 feet, and the thickness of the salt about 30 feet. Exceptionally deep wells have been driven to a depth of 1,600 feet through six layers of salt aggregating 125 feet in thickness. The salt area of Canada is estimated at 2,000 square miles, and the probable quantity of salt still in the beds is called 200,000,000,000 tons. The Canadian salt is superior to the Michigan salt in regard to the absence of the earthy chlorides, as the following analysis will show:

	Goderich Salt.	East Saginaw Salt Company.
Sulphate of lime	0·989	0·317
Chloride of calcium	0·134	0·356
Chloride of magnesium	0·124	0·141
Insoluble	0·037	0·000
Moisture	1·396	3·344
Loss	0·016	0·000
Pure salt	97·304	95·842
Total parts	100·000	100·000

The salt-beds of Michigan underlie each other like a nest of saucers—the oldest being in the old dolomite limestones in the ancient

Devonian ocean. Here alone we have the beds of pure rock-salt. As we come nearer the surface, the presence of the earthy chlorides is more marked, and the product is less valuable, because, by reason of its attracting more moisture from the air, it is rendered unfit for the dairy or the table unless it goes through a process of purification. The conclusion that we must reach, therefore, is, that the deeper the boring goes, the purer the salt will be, whether it is in Michigan or in New York. Following out the logical deduction of this conclusion, we must admit that while the outcroppings of salt toward the northern edge of the New York field might offer superior inducements in the way of securing the brine, yet the brine when secured would be so much weaker and more impure that the decreased cost of producing it would be more than offset. In other words, the brine that is reached at a depth of two hundred feet north of the Warsaw Valley offers no superior advantages to that which for many years has been reached at a similar depth on the reservation of the Onondaga Salt-Springs. In deep boring and pure salt lie the best hopes of the Warsaw product.

The relative value of brine from the various salt-producing localities is shown by the following table, which gives the number of gallons of brine required to make one bushel of salt :

Sea-water	300 to 350
Boone Lick, Missouri	450
Conemaugh, Pennsylvania	300
Jackson, Ohio	213
Lockhart's, Mississippi	180
St. Catharine's, Ontario	120
Zanesville, Ohio	95
Grand River, Arkansas	80
Kanawha, West Virginia	75
Montezuma, New York	70 to 50
Muskingum, Ohio	50
Onondaga, New York	45 to 30
Saginaw, Michigan	30 to 25
Goderich, Ontario	22
Warsaw, New York	20

Not only is it claimed that the Warsaw salt is superior to any other for the packing of meats and the uses of the dairy, but also that it is the sole product in the United States from which soda-ash can be manufactured. This article is used for bleaching, dyeing, soap-making, and several other processes. Hitherto it has been imported to the value of millions of dollars yearly, because no brine of sufficient strength could be found in the United States. Attempts to use the brine of Canada and Ohio have utterly failed. At last the brine of Syracuse was tried, and it was found that by being chemically treated and salted it would serve the purpose. Large amounts of capital are already invested in the strengthening of the Syracuse brine; but it is

found that the Warsaw brine is strong enough to be used without any chemical treatment. Large investments, therefore, are making, in the Wyoming Valley, for the manufacture of soda-ash; and the success of these manufacturers will make the United States independent of every other country in regard to this commodity. Of course, the salt-men of Warsaw are as clear-cut protectionists as are their fellow-workers of Syracuse or Saginaw. The duty on foreign salt is eight cents per hundred, or twenty-two cents for a barrel of two hundred and eighty pounds. They argue that salt having dropped from one dollar and eighty cents a barrel in 1860, to seventy cents in 1882, the saving of one dollar and ten cents on a barrel has been an aggregate of seven million dollars to the people of the United States. To remove the tariff, they affirm, would be to raise the price, to shut down home industries, and to allow foreigners to make the money that should be kept in this country.

The outward appearance of a salt-well in the Wyoming Valley does not differ materially from that of a well in the "oil-country." We see the same derrick, of spruce or hemlock; the ponderous wooden walking-beam, half out-of-doors; the "bit," the "auger-stem," and all the other appliances for boring, together with the "pull-wheel" that hoists the whole apparatus from the hole; the forge hard by; the "sand-reel" that lowers the pump for clearing away the pulverized rock; and the "fishing-tools" and all other tools for clearing the well of bits of broken apparatus. A short distance from the derrick is a covered shanty which contains the engine, while the boiler is still farther away, and generally in the open air. With such an apparatus, the cost of boring is from seventy-five cents to one dollar per foot for operating expenses. The workmen serve in gangs—two for each twenty-four hours—and the wages are one dollar and fifty cents per day. The drill first strikes through thirty feet of heavy clay; then fifteen feet of slate or Marcellus shale; then one hunded and fifty feet of corniferous limestone; then fifty feet of hydraulic limestone; then about twelve hundred feet of saline shales, at the bottom of which is a stratum of salt averaging eighty feet in thickness. Still below this are the Niagara limestone and other members of the Niagara group.

The stratum of salt having been once pierced, a saturated solution of the saline matter frequently rises in the boring to within eighty feet of the surface. This, however, can not always be depended upon—and here center the increased difficulty and expense. When a few dozen feet have been drilled, a six or an eight inch iron pipe is inserted as a "casing." Inside of this a two-inch pipe—also of iron—is placed. The "casing-head" has two openings—one for the entrance of pure water from a neighboring spring into the larger pipe, at the lower end of which it becomes saturated with saline matter; the other at the end of the smaller pipe, to allow the expulsion of the brine. Of

course, the wells become foul or leaky at times, and then resort is had to torpedoes of nitro-glycerine, which are sent down to the bottom of the "casing," and after them is sent an iron weight which secures the explosion. The rusting of the "casing" is the great enemy of the salt-worker; and, when his engine can not lift the mass of rusted iron, a "knife" cuts the rusted metal, and the engine tears it away piecemeal. But the salt-wells are exempt from any danger of taking fire; and it is never necessary, as in the case of oil-wells, to shoot off the "casing-head" with a cannon-ball.

After the brine has once reached the surface it is forced into large reservoirs, whence it is drawn off through "string" after "string" of "covers," until solar evaporation has left the coarser grades of salt. The "covers" or vats are usually sixteen by eighteen feet, and the product of each one per year is estimated at one hundred and fifty bushels; while the product at Syracuse is only about half that quantity. It is also claimed that the slope of the valley at Warsaw is peculiarly adapted to rapid evaporation by the sun. When the finer grades of salt are wanted, the brine is led from the reservoirs to an evaporating-pan, where a gentle heat is applied. Similar treatment in another pan completes the process, and the residuum of salt is raked upon a shelf at the side of the evaporator. After a slight draining it is taken to the bins, where a more thorough draining is allowed for a space of two or three weeks. The heat is applied to the evaporating-pans through steam-pipes, in the same manner that has been found most economical both at Saginaw and Syracuse. At Saginaw the fuel costs next to nothing, as it is the refuse of the lumber-mills; and the exhaust steam of the mills is also used for the pipes of the evaporating-pans. At Syracuse and at Warsaw the expense for fuel is greater, Warsaw using anthracite coal-dust, or "culm," at an expense of one dollar and sixty-five cents per ton. Whence, then, does Warsaw derive its hope for successful competition against Syracuse and Saginaw? The ever-ready answer is, that the strength of brine at Syracuse is sixty-six to one hundred at Warsaw—a difference that makes the cost of fuel twenty cents per barrel for Syracuse as against eight cents for Warsaw. In regard to the Saginaw brine, also, it is claimed that its residuum after evaporation is ninety-seven per cent of pure salt; while that of the Warsaw brine is one hundred—a difference which, if sustained, would amply cover the increased cost of fuel at Warsaw. The salt-men of Warsaw, too, have the greatest confidence that their borings for natural gas will result in giving them a fuel even cheaper than culm. The Warsaw men also declare that their own enterprises are on private land; and that they, therefore, have an advantage of the salt on the Syracuse reservations, every bushel of which must pay half a cent per bushel to the State. And they do not fail to call attention to the fact that the duty was one cent per bushel before the borings at Warsaw had proved a success. In short, they see no reason

why Warsaw should not furnish a large share of the six million barrels of home-made salt that are required every year, even if Syracuse gives a million and a half and Saginaw three and a quarter millions toward the product.

THE MORALITY OF HAPPINESS.

By THOMAS FOSTER.

CARE OF OTHERS AS A DUTY.

I ENTER now on a portion of my subject where I shall seem less at issue with those who repeat with their lips, and fancy they hold in their hearts (though they never think of following in their lives), certain rules of conduct in which due care of self is treated as objectionable and evil is spoken of as not to be resisted but encouraged. I shall still be at issue with those who assert, apparently without thinking—certainly without alleging any reasons—that conduct and duty are not matters for scientific discussion at all, that they have no scientific aspect, and that such considerations as the progress and improvement of life, the increase of the fullness and happiness of life, and so forth, have no bearing whatever, and should have none, on our opinion as to what is right or wrong. But we may very well afford to disregard objections having so little relation to actual facts. Every one really guides his conduct in large part by such considerations as many thus allege to have no proper bearing on conduct; nor can any one draw a line beyond which such considerations must not operate: when any one has tried to do so, and perhaps imagines he has succeeded, then I shall simply meet his objection with the remark that he need consider what I have said and what I may hereafter say as only applying to such parts of conduct as he has admitted to be within the range of scientific discussion.

Let us take, now, the doctrine that while due care of self comes to each man, and indeed to every creature having life, as essentially *first*, yet due care of others—though second to due care of self—is as absolutely essential. The two are interdependent—and that to such degree that neither can exist without the other. The great difference in the treatment which science has to extend to the two forms of duty—the egoistic and the altruistic—resides in this, that whereas in insisting on egoistic duties science is really insisting on what every normally-constituted man is already apt to attend to, in insisting on altruistic duties science is insisting on duties wofully neglected, despite the fervor with which they are verbally enjoined. Many reject egoistic duties in words, who look so carefully after their own interests in action that those who inculcate due care of self as a duty are ashamed to have to admit such utter selfishness as among the results

(the unwholesome fruits, as it were) of the process of development which conduct, like all things else, has undergone, is undergoing, and will ever continue to undergo. The truth is, that the careful study of what may be rightly sought and claimed for self is no unworthy preparation for due thought and care of others.*

Let us briefly trace the development of altruism.

In many of the lower forms of animal life, the acts which tend to race-maintenance are altruistic. The parent is sacrificed wholly or partially in the production of progeny. Nor even in the higher forms of life does this form of sacrifice disappear, though the very beginning of new existences may involve egoistic rather than altruistic relations. Unconsciously at first, but consciously afterward, and later still by definite actions to that end directed, the mother of each new member of even the human race divine sacrifices herself for her offspring. We may be said to imbibe altruism with our mothers' milk. Every act by which in babyhood our life was fostered was a practical exemplification of the doctrine that care of others is essential to the maintenance and progress of the race. To altruism each one of us owes life itself, and the human race owes its existence as certainly to altruism, though such altruism was secondary to egoism in its influence.

And note here, in passing, how development of conduct is related to this early altruistic care of the individual life. As certainly as a want of due care of self leads to the diminution of altruism, by causing those who are not duly egoistic to disappear from the scene of life and leave no successors or few, so does want of due care of others, in the nourishment and rearing of offspring, lead inevitably to the diminution and eventual disappearance of types not sufficiently altruistic. The careless, unloving mother is unconsciously doing her part in eliminating selfishness from the world (the process, however slow, is a sure one), for the child she neglects shares her nature, and must thrive less than a child of happier nature nursed and cared for by a more loving mother. In whatever degree individual instances may seem to tell against this process of evolution, in the average of many cases and through many generations the law must certainly tell.

Nor is this law limited to the influence of the parent who has most to do with the earlier years of life. Throughout childhood and in greater or less degree to the hour and even beyond the hour when each man and each woman begins to take part in the duties of life, and in most cases in the actual struggle for life, development depends on cares which will be well bestowed by unselfish parents, and so tend to increase the amount and fullness of unselfish life, while the selfish will neglect them, and so unconsciously help to eliminate (in the long run) the more selfish natures. It must be so if there is any truth in

* Even the doctrine so many preach but so few practice, "Care for others as for self," would be somewhat unsatisfactory if our care of self was insufficient; it ought, then, to run, "Neglect the rights of others as you are careless of your own."

the doctrine of heredity, and the doctrine is not only true but is universally recognized: it is scarcely more clearly and certainly recognized now than it was by those who in old times made the pregnant proverb, full of old-world wisdom and experience, "The fathers have eaten sour grapes, and the children's teeth are set on edge." Fathers and mothers who are selfish by nature rear with less care offspring who as certainly inherit their nature as the young of beasts of prey inherit the carnivorous tastes of those to whom they owe their lives. Hence, fortunately for the race—seeing how many egoistic tendencies are apt to be fostered in the struggle for life—a constant tendency to the elimination of the more selfish natures.

To this may be added the consideration that the ill-reared and unduly egoistic are less likely than those of more generous and altruistic nature to be found pleasing by those of the opposite sex, less likely therefore to marry, so that (speaking always of the average not of individual cases) there is yet another factor opposing the increase in number of the unduly egoistic.

Thus do we recognize on the one hand that within families a due degree of altruism is essential to the development of life and life's fullness, while on the other hand undue egoism tends directly in more ways than one to diminish happiness.

The best proof that such influence is exerted is found in the circumstance that in every advancing community the young are cared for with constantly-increasing care. Among savage races offspring receive few altruistic attentions. They are not reared in the full sense of the word. Almost from the beginning of their lives they have to take part in the struggle for life. In civilized communities they are cared for during many years, and they are better, more thoroughly, and more wisely, cared for, the more such communities advance. All this indicates and enables us to measure the development of altruism, so far as the family is concerned.

And that care of others in this case (i. e., within the family) is not only essential to the development of life and its fullness, but also to the happiness of self, will be clear if we consider the matter with the least attention. For the altruistic nature shown in the care of children is inherited by children and developed in them by such care. Hence, as Mr. Spencer well notes, there results such conduct on the part of children as "makes parenthood a blessing." Of the parent of children inheriting such natures and so reared, it may be said that, even in our days (to which the saying of the Hebrew Psalmist was not, I suppose, intended originally to apply), the man is blessed that hath his quiver full of them.* On the contrary, where the parents and therefore probably the children are of selfish nature, and the example set the children is unduly egoistic, parenthood is no blessing, and may well

* So only that it be not so full as to give the little arrows but a narrow space to turn in; for so can not the young idea be daily taught to shoot.

become a source of misery. What happens in this case? asks the philosopher whose treatment of the scientific aspect of duty we are following. "First the domestic irritations must be relatively great; for the actions of selfish children to one another and to their parents cause daily aggressions and squabbles. Second, when adult, such children are more likely than others to dissatisfy employers, alienate friends, and compromise the family by misbehavior, or even by crime. Third, beyond the sorrows thus brought on them, the parents of such children have eventually to bear the sorrows of neglected old age. The cruelty shown in extreme degrees by savages who leave the decrepit to starve is shown in a measure by all unsympathetic sons and daughters to their unsympathetic fathers and mothers; and these, in their latter days, suffer from transmitted callousness in proportion as they have been callous in the treatment of those around. Browning's versified story 'Halbert and Hob' typifies this truth."

We turn next from altruism in the family to altruism as an essential part of social conduct.

The relations within a family present on a small scale a picture of the relations among the members of a race or nation, as these in turn present a miniature of the relations between the different races and nations which form the human family. As men rise in the scale of being, they pass from the sense of duty within the family to the sense of duty between man and man throughout society, and thence—though as yet this development is very limited—to the sense of right between different races and nations. We have seen that undue care of self is self-injurious and eventually must be self-destructive in the family. There is a corresponding law for undue care of self in social relations, as there is (however persistently at present the vast majority of men overlook or fail to see the fact) for undue regard of self among the nations. We may mistakenly regard undue care of self in the body social as cleverness, aptitude for business, and so on; and we may mistakenly regard national selfishness as patriotism: but the process of evolution is as certainly working toward the elimination of one as of the other form of undue egoism.

The main condition of social welfare and of social progress is that the union which society implies shall work for the benefit of those associated. If the balance of effects resulting from association be evil, the body social must inevitably dissolve in the long run.

Now, by laws of greater or less severity the members of a race or nation may be compelled to recognize each others' claims. Or such recognition may be assured by the fear of retaliation if the claims of others are neglected. In such cases, however, the gain to each, or the egoistic advantage of association, is small. Enforced recognition of altruistic rights is in itself disagreeable. The more disagreeable it is the oftener will cases arise where the laws have to be called into operation (and their operation is by our supposition painful), or where

retaliatory action is aroused, with waste of energy and disagreeable effects on either side. A society so restrained is held together by but weak bands, and is ill fitted to support itself against external enemies. Internal co-operation for the benefit of the community can not be active under such circumstances. The products of labor are insecure. Moreover, whatever has to be done in the way of self-protection or of the safeguarding of property is so much withdrawn from the advancement of the general interests of the body social.

We have only to consider the condition of any European country, our own included, in the good old times which so many ignorant persons regret as a sort of golden age, to see how unsatisfactory must be the state of a nation in which only a stern code of laws, or the dread of retaliation, protects each against the undue egoism of his fellows. Internal wrong-doing and the necessity for constant struggle to resist such wrong-doing made each nation unstable. Our good old England was invaded and conquered over and over again in consequence of instability so produced. From long before the invasions by Saxon hordes under pirate chieftains to long after the invasion by Normans under the bastard descendant of the pirate chief Rollo, England was made wretched and miserable by constant contests, having their origin invariably in that undue egoism which we now call rapine and plunder. None—not even the most powerful—were secure. The castles we find so picturesque and romantic, the battles which seem glorious, the chivalry in which we see so much splendor, all tell us of a state of barbarism, of abject misery for the majority, of magnificent discomfort for the powerful. In the unsafety of those days, however, resided the certainty that the undue egoism of "the good old times" would by a natural process of evolution be eliminated. It is not yet fully eliminated; probably centuries will elapse before it is even in great part got rid of; but it is manifestly much reduced. We still have laws to protect us against wrong-doing, but the worst wrong-doers—those who of yore were the principal component parts of the body politic—no longer exist in the same way as of old. A much larger proportion of the social body recognize regard for others as a duty; no inconsiderable proportion recognize it as a pleasure; and, what is of more importance still, men recognize the advantage of encouraging these changed tendencies.

These changes have come on so gradually that few consider how important they really are. It is not too much to say that a large proportion of the Englishmen of our day would find life not worth living if the old state of things were restored; if, for instance, life and property and reputation became as insecure now as in the days of the Plantagenets, the Tudors, or even the Stuarts.

And here it may be noticed that those who neglect the consideration that they form part of the social body and refrain from the taking due part in maintaining a healthy social state suffer from the

defective arrangements which they permit to remain uncorrected. We see this in very marked degree in America, though it can be recognized clearly—far too clearly—in our own country. There the best men keep out of politics for a reason which rightly understood should make all the best men take most anxious interest in politics. Because in America offices are too often filled by mere adventurers, because bribery and corruption are rife, and because fraudulent conduct is common among politicians, therefore should it be held the duty of every right-minded American to do his best to enforce the wholesome changes so obviously required—as they might be enforced if so many of the best Americans were duly altruistic. But as a matter of fact the very circumstance which should arouse all the best in America to vigorous action is made the chief reason for withdrawing from public duties.

In our own country the same undue egoism shows itself in another and a scarcely less mischievous form. The individual members of the community find relief in the thought that social duties may be handed over to government. It seems easier to talk laws into existence for getting things done than to do them. The laws are easily passed, but the doing of what is necessary passes in a great number of cases into the hands of men not nearly so much interested in the doing of it as those who passed the laws appointing them to the work—nay, often by the very nature of the laws so passed, interested rather in delaying than in pushing on the work.

As Mr. Spencer well puts it, the man who thus shirks the duties which he owes to the community of which he forms part, who plumes himself on his wisdom in minding his own business, "is blind to the fact that his own business is made possible only by maintenance of a healthy social state, and that he loses all round by defective governmental arrangements. When there are many like minded with himself—when, as a consequence, offices come to be filled by political adventurers, and opinion is swayed by demagogues—when bribery vitiates the administration of the law and makes fraudulent state transactions habitual; heavy penalties fall on the community at large, and among others on those who have thus done everything for self and nothing for society. Their investments are insecure; recovery of their debts is difficult; and even their lives are less safe than they would otherwise have been. So that on such altruistic actions as are implied, firstly in being just, secondly in seeing justice done between others, and thirdly in upholding and improving the agencies by which justice is administered, depend, in large measure, the egoistic satisfactions of each."

Apart from dangers directly affecting life and property, those resulting from undue egoism in business relations show the necessity of just altruism for the welfare and happiness of the social body. Not only is it well for each to recognize the rights of others, but each is

interested in securing due recognition of altruistic rights by his fellows. The evils resulting from business frauds affect the welfare of the community. To quote the illustrative cases cited by Mr. Spencer, "The larger the number of a shopkeeper's bills left unpaid by some customers, the higher must be the prices which other customers pay; the more manufacturers lose by defective raw materials or by carelessness of workmen, the more must they charge for their fabrics to buyers. The less trustworthy people are, the higher rises the rate of interest, the larger becomes the amount of capital hoarded, the greater are the impediments to industry; the further traders and people in general go beyond their means, and hypothecate the property of others in speculation, the more serious are those commercial panics which bring disasters on multitudes and injuriously affect all."—*Knowledge.*

THE MYSTIC PROPERTIES OF NUMBERS.

BY ÉTIENNE DE LA ROCHE (1538).

ONE of the earliest French mathematical books is the arithmetic of Étienne de la Roche, in which, the title-page states, are given tables of different accounts, with their canons, calculated by Gilles Huguetan, native of Lyons: "in which may easily be found the accounts all made, as well of purchases as of sales, of all kinds of merchandise. And, principally, of goods which are sold or bought by measure, as by the ell, by the cane, by the toise, by the palm, by the foot, and the like. By weight, as by the pound, by the quintal, by the thousand-weight, by the load, by the half-pound and the ounce, by the piece, by the number, by the dozen, by the gross, by the hundred, and by the thousand. With two tables of use to booksellers, in selling and buying paper, together with a table of expense, showing, at so much a day, how much one spends by the year and the month, and at so much a month how much it comes to by the year and the day, and at so much a year how much one spends in a month and how much it comes to for each day.

"Further, tables of the fineness of gold and silver, showing, according as the coin contains of alloy or fine metal, how much it is worth in the weight of fine gold or of fine silver.

"Sold at Lyons, at the sign of the Sphere, by Gilles and Jaques Huguetan Brothers, 1538."

We give the first chapter of this curious work, which treats of the first twelve numbers, their properties and perfections. Our modern works, while they are less unsophisticated, are certainly far less amusing in expounding the beginnings of arithmetic:

"Number, according to Euclid, at the beginning of the seventh

book: *Est multitudo ex unitatibus composita* (is multitude composed of units). And, again, in the third part of his first book he says: *Seriem numero et in infinitum posse procedere ut quocumque numero dato dari potest major unitatem addendo.* (A series in number may go on to infinity, so that any given number may be made larger by adding unity.) And in this way number is an aggregation or collection of one or many units. And to proceed *in infinitum* by the addition of one. From which it appears that unity is not number; but, on the contrary, is the root and foundation of numbers. Even as Boëthius says in his arithmetic. Nevertheless, one is higher and more perfect than all the numbers that are. For in it are united potentially the property and perfection of all numbers. And without it nothing can have being. And Euclid, at the beginning of the seventh book, says: *Unitas est qua una quacumque res una dicitur* (Unity is that by which any one thing is called one). And the logicians say that one is one of the six transcendent principles. For it comprehends all things that have being. Then, again, it has all the property of number. For it is perfect, like six, it is lineal, square, cube, solid, square root, cube root, root of root. And because it is of so great dignity and excellence, the Creator has chosen it for his essence; for he is one only God, creator of all the world. A good law, to wit: the Christian law, divided into ten commandments. And a good faith: to wit, the Catholic faith, divided into twelve articles. And so many other dignities and perfections.

"Two is a number of so great pre-eminence and utility that God has kept it in mind in many of his works. For first, he created light and darkness. Then he created two great lights, to wit, the sun and the moon. The sun, to light the day; and the moon, to light the night. Then he created all beasts in two sexes, to wit, masculine and feminine; and made for them several double members, to wit, two eyes, two ears, two nostrils, two arms, two hands, two legs, two feet and many others of utility to the human body. And then, as many passions as the human body suffers, such as joy and sadness, hope and fear, hunger and thirst, heat and cold, drinking and eating, sleeping and waking, health and sickness, living and dying, and all relative qualities are also constituted in duplicity, as creator and creature, parent and son, creating and created, producing and produced, abstract and concrete, etc. And also all opposites, as kindness and malice, virtue and vice, knowledge and ignorance, wisdom and foolishness, truth and falsehood, etc. And we think that after unity more things are found constituted by two than by any superior number.

"Three is the most worthy and most perfect, after one, that is among the numbers. Thus, as says almost every one's maxim, *Omne trinum perfectum* (Every trine is perfect). And the perfection does not proceed by the composition of it, as it does of six. But by the great and high mysteries that are found in this number. And first, it

has pleased God, the Creator, to be trine in persons. To wit, Father, Son, and Holy Ghost. It has pleased him to create three hierarchies; and in each hierarchy three orders of angels. There are three things in Jesus Christ, to wit: deity, the soul, and humanity. The priest makes three parts of the precious body of Jesus Christ in the mass. Three holy orders sing the mass, to wit: the priest, the deacon, and the sub-deacon. Three times are sung the *Sanctus, Sanctus, Sanctus;* and the *Agnus Dei qui tollis peccata* in the mass. By three nails was fastened the Blessed Redeemer Jesus Christ on the cross. There are three degrees of penitence, to wit: contrition, confession, and satisfaction. There are three parts of satisfaction, to wit: fasting, alms, and prayer. There are three divine virtues, to wit: faith, hope, and charity. There are three enemies of the soul, to wit: the world, the flesh, and the devil. Man sins in three ways, to wit: with heart, with word, and with deed. Man may offend three things, to wit: God, himself, and his neighbor. God has disposed all things by number, by weight, and by measure. *Tria erant in archa; s. c. g. Virga; manna et lex Mosayca* (there were three things in the ark: the rod, the manna, and the Mosaic law). Three places are deputed for man after his death, to wit: paradise, purgatory, and hell. Three vows do the minor friars vow when they make profession, to wit: poverty, obedience, and chastity. There are three natural principles, to wit: form, matter, and privation; or, *potentia* (power); *objectum* (object); *et actus* (and act). There are three souls, to wit: vegetative, sensitive, and rational. There are three powers in the rational soul, to wit: will, memory, and understanding. Bodies have three dimensions, to wit: length, breadth, and thickness. The world is divided into three parts, to wit: into Asia, Europe, and Africa. And thus appears the excellence and magnificence of this worthy number three.

"Four is the first square number, and is of great esteem and necessity. And first, God, the Creator, has created four elements, to wit: fire, air, water, and earth. Whence proceed four qualities, to wit: warmth, frigidity, dryness, and moisture. From which arise four humors, to wit: blood, bile, phlegm, and melancholy; by which are caused four complexions, to wit: sanguine, choleric, phlegmatic, and melancholic. There are four seasons in the year, to wit: spring, summer, autumn, and winter. And four quarters in the sky and the world, to wit: eastern, western, northern, and southern. And to each quarter one principal wind, to wit: the morning or east-wind, the traverse or west-wind, the north-wind or transmontane, and the sea or south-wind. And, according to the philosophers, there are four causes in all things, to wit: the efficient, formal, material, and final causes. There are four cardinal virtues, to wit: prudence, temperance, strength, and justice. The glorified body in paradise has four endowments, to wit: brightness, subtilty, agility, and impassibility. There are four evangelists to certify the faith of Jesus Christ. And four principal doctors

of the Church to corroborate the faith, to wit: St. Augustine, Gregory, Hieronymus, and St. Ambrose.

"Five is a number of great convenience and utility; for, first, the Creator created five simple bodies, to wit: the sky, fire, air, water, and earth. And never have more of regular bodies that have equal bases been found. Then, for our use, the Creator has given us five natural senses, to wit: sight, hearing, taste, touch, and smell. And five fingers on the hand, and five toes on the foot. And to redeem us has suffered five wounds on the cross, and in all the surface of the earth there are five zones, according to Sacrobosco in his sphere.

"Six is the first and most worthy of the perfect numbers. Because in its composition three aliquot parts put together make their whole: as 3, 2, and 1, which are its ½, its ⅓, and its ⅙. Which put together amount to 6, which is their whole. There is another perfection, because it is a circular number. For, in making a circle with a compass, the circumference of the circle contains just six times the span of the compass; as when one should put one of the feet of the said compass on the circumference of the said circle, and should turn the said compass to six times on the said circumference. At the sixth time the said foot of the compass would return to its first point. And because it returns always in itself. *Et semperidem ipse est* (and it is always the same). There is also another perfection, because there are six transcendent principles, to wit: one, good, true, thing, something, and being. And for these great perfections and dignities, the Creator regards it in his works, for he created everything in six days. Therefore ought it to be named the very perfect among the perfect numbers. So has St. Augustine said in the thirtieth chapter of the second book '*De Civitate Dei.*'

"Seven is a number of great prerogative and singularity, as St. Augustine says in the thirty-first chapter of the aforesaid book. Because of its composition which is triple, for first it is composed of 1 and of 6, which are of so great perfection as is said above. Or of 3 and 4, which are of so great dignity and estimation. Or of 2 and 5, which are of so great utility and commodity. And because in its composition it contains so many numbers worthy, perfect, and of great excellence. God, the Creator, regards it in his most admirable works. For he has created seven planets, seven metals, seven colors, and seven tastes. And when he had created everything in six days, he rested on the seventh, which is a thing of great mystery. There are, therefore, seven days in the week. There are seven principal virtues, to wit: three divine, and four cardinal. There are seven other virtues against the seven mortal sins. There are seven works of bodily mercy and seven works of spiritual mercy. There are seven sacraments. There are seven orders in the holy church. There are seven ages of man. There are seven windows through which the ordinary senses are exercised: the two eyes, the two ears, the two nostrils, and the

mouth. There are seven days between the setting in of a disease and the critical day. There are seven climates in the habitable earth.

"Eight is the first cube number, and there are also eight beatitudes.

"Nine is the second square number, and there are also nine orders of angels and the *kyrie eleison* is sung nine times in the mass.

"Ten, according to some, is a perfect number, not in its composition like six, but because it contains inclosed in itself all the simple numbers and all the properties, as of even and odd, perfect and imperfect, and it is the beginning of all numbers composed of tens, and also for the foundation of our law. God gave to Moses the ten commandments of the law, and ordered men to give to God the tithe, which is one tenth of his gain or his labor.

"Eleven is the first compound odd number.

"Twelve is a number of great pre-eminence and utility. And, although it is an excessively imperfect number, it is nevertheless of great utility. For it can, first, be divided into more parts than any number below it. For it can be evenly divided by 6, which is its $\frac{1}{2}$; by 4, which is its $\frac{1}{3}$; by 3, which is its $\frac{1}{4}$; and by 2, which is its $\frac{1}{6}$. And because the blessed Redeemer Jesus Christ wished to observe the said number in choosing twelve apostles to found and form the Holy Catholic Faith. Who for the foundation of the same composed the twelve articles of the faith. And in imitation of them the lords of the cathedral churches constitute twelve perpetuals to listen continually to the service of God the Creator; twelve choralists to sing the hymns of God and the saints. Likewise, on account of the convenience of this number, the good governors of cities commonly choose twelve counselors to attend to the regulation of the public good. So the astrological philosophers of the ancient times, experimenting and considering the celestial natures and influences, divided the whole sky into twelve equal parts which were called the twelve signs. And they attributed to each a peculiar influence by subtile commixtion, and established twelve months in the year for greater convenience. And this is enough of the property of the numbers in particular.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

SKETCH OF PROFESSOR FELIPE POEY.

By Professor DAVID S. JORDAN.

"AH, but you must see Don Felipe—he knows all about fishes!" is the first advice which the naturalist receives when he begins to make collections of fishes in the markets of Havana. The writer once had occasion to make such a collection, and he found soon that, among fishermen and fish-mongers, the phrase "amigo de Don Felipe" was ever a passport to honest dealing and to a real desire to aid him in

his work. For every fisherman in Havana knows "Don Felipe," and looks upon him as a personal friend. Each one regards the fame which Don Felipe's studies of the fishes is vaguely understood to have brought him in that little-known world outside of Havana as in some sort reflected on himself. The writer was told, by a dealer in the Pescadería Grande, that for twenty years Don Felipe Poey was there in the markets every day, when at noon the fishes came in from the boats, and that he knew more about the fishes of Cuba than even the fishermen themselves. And, now that Don Felipe no longer visits the markets, he is not forgotten there, and many a rare specimen still finds its way from the Pescadería to Don Felipe's study in the Calle San Nicolas.

Felipe Poey y Aloy was born in Havana, May 26, 1799. His father was French, his mother Spanish, but Poey early renounced his French citizenship for that of Cuba. His education was received in Havana, and after studying law he became, in 1823, an advocate in that city. But his tastes lay in the direction of natural history, and for this he gradually abandoned his practice as a lawyer. Very early he had made discoveries of mollusks, insects, and especially of fishes, which were new to science. In 1826 he sailed for Paris, taking with him eighty-five drawings of Cuban fishes and a collection of thirty-five species, preserved in a barrel of brandy. These drawings and specimens he placed at the service of Cuvier and Valenciennes, who were then beginning the publication of their work on the "Natural History of the Fishes." The notes and drawings of Poey proved of much service to the great ichthyologists. A few new species were based on them, and Poey had the satisfaction of finding his own name and observations cited by Cuvier and Valenciennes even more frequently than those of his famous predecessor, Don Antonio Parra,* who had published, in 1787, the first account of the "Fishes of Cuba." A set of duplicates of these notes and drawings is still retained by Professor Poey. While in Paris, Poey was one of the original members who founded the Entomological Society of France.

On returning to Havana in 1833, Poey gave himself still more fully to the study of natural history, and greater practice gave to his drawings and notes more exactness and value. With the appearance of the successive volumes of the "Histoire Naturelle des Poissons," he attempted to identify the fishes of his market, as well as to study their osteology and general anatomy. Animals other than fishes he also tried to study, but in most groups he found the literature in so scattered and unsatisfactory a condition that he rarely ventured to publish the results of his observations. Among the fishes, however, thanks to the general work of Cuvier and Valenciennes, and later to that of Dr. Günther, he felt himself on comparatively firm ground, and ventured to name as new those which he could not identify. Among the land-

* "Y tuve el honor de ser citado por él (Cuvier) y por su colaborador Valenciennes, más frecuentemente que D. Antonio Parra."—Poey.

snails, too, Poey and his associate, Dr. Gundlach, were able to act with certainty, as all the species then known were included in the "Monographium Heliceorum Viventium" of Dr. Ludwig Pfeiffer.

In the year 1842 Poey was appointed to the professorship of Comparative Anatomy and Zoölogy in the Royal University of Havana, which chair he still holds, after forty-two years.

The University of Havana occupies an ancient monastery building in the heart of the city. Like most similar edifices in Cuba and Spain, it is a low building around a hollow paved court, and its whitewashed, time-stained walls have an air of great antiquity. The university has now some twelve hundred students, the great majority of whom are in those departments which lead toward wealth, or social or political preferment, as law, medicine, and pharmacy. Comparatively few pursue literary or philosophical studies, and still fewer are interested in the biological sciences. In the department of botany there are now but two students, and the number in zoölogy is probably not much greater.

Although Professor Poey is evidently held in very high respect in the university, in which he has long been dean of the faculty of science, I can not imagine that he ever received much help or sympathy in his scientific work from that quarter, or indeed from any other in Cuba. His friends and countrymen are doubtless glad to be of assistance to so amiable a gentleman as the Señor Don Felipe, but for the claims of science the people of Cuba, as a class, care very little.

The university library contains but little which could be of help in Professor Poey's zoölogical studies. He has therefore been compelled to gather a private library of ichthyology. This library has with time become very rich and valuable, many of his co-workers in the study of fishes, notably Dr. Bleeher, having presented him with complete series of their published works.

The museum of the university occupies two little rooms, the one devoted chiefly to Cuban minerals, the other containing mostly mammals, birds, and fishes mounted by Poey himself in the earlier days of his professorship. The number of these is not great, nor have many additions been made during the last twenty years. Of late the types of the new species described by Professor Poey have been, after being fully studied by him and represented in life-size drawings, mostly sent to other museums, notably to the United States National Museum, to the Museum of Comparative Zoölogy and to the Museum of Madrid. Duplicates have been rarely retained in Havana, the cost of keeping up a permanent collection being too great. As a result of this, Professor Poey's work has sometimes suffered from lack of means of comparing specimens taken at different times. There is no zoölogical laboratory in Cuba except the private study of Professor Poey, and here, for want of room and for other reasons, drawings have, to a great extent, taken the place of specimens.

The publication of the observations of Professor Poey on the

animals of Cuba was begun in 1851, in a series of papers entitled "Memorias sobre la Historia Natural de la Isla de Cuba." These papers were issued at intervals from 1851 to 1860, and together form two octavo volumes of about 450 pages each. The first volume contains chiefly descriptions of mollusks and insects. The second volume is devoted mainly to the fishes.

As is natural in the exploration of a new field, these volumes are largely occupied with the description of new species. They give some evidence of the disadvantages arising from solitary work, without the aid of the association and criticism of others, and without the broader knowledge of the relations of groups which comes from the study of more than one fauna. On the other hand, Professor Poey enjoyed the great advantage of having an almost exhaustless supply of material, for there are few ports where fishes are brought in in such quantities, or in such profusion of variety, as in the markets of Havana.

The "Memorias" were at once recognized as the most important work on the fishes of Cuba, and, as was said long ago by Professor Cope, this work is a *sine qua non* in the study of the ichthyology of tropical America.

The nomenclature and grouping of the species in the "Conspectus Piscium Cubensium," contained in the "Memorias," was in 1862 the subject of a critical paper by Dr. Theodore Gill.* This article, and subsequent ones by the same author, exerted much influence on Poey's work. He was always ready to profit by the suggestions and advice of other writers, especially of those more favorably situated than he in regard to libraries and museums, and from Professor Gill's papers he drew clearer views of the relations of forms, and of the connection of the Cuban fauna with that of other regions. On the other hand, he was led to adopt, against his own judgment in many instances, that minute subdivision of genera which has been a fashion in American ichthyology, and which has been in some quarters a reproach to American science.

In 1868 the results of the revision of his classification were embodied in a second catalogue of the Cuban fishes, entitled "Synopsis Piscium Cubensium." This forms the concluding chapter of a series of papers, entitled "Repertorio Físico-natural de la Isla de Cuba," which embody the results of a general scientific survey of the island. Of this survey Professor Poey was director. In 1875 the entire list of species was again revised, and the third and best catalogue of Cuban fishes was published under the title of "Enumeratio Piscium Cubensium." Besides these larger works, many shorter papers by Poey occur in the "Proceedings of the Academy of Natural Sciences" of Philadelphia, the "Annals of the New York Lyceum," and the "Anales de la Sociedad de Historia Natural de Madrid." He is also the author

* "Remarks on the Genera and other Groups of Cuban Fishes," "Proceedings of the Academy of Natural Sciences," Philadelphia, 1862, pp. 235, *et seq.*

of a "Geography of Cuba," and of a "Treatise on Mineralogy," used in the Havana schools. A number of poems from his pen have likewise been published, but these I have not seen.

The great work of Poey's life is the still unpublished "Ictiología Cubana." This is to contain a detailed account of each of the fishes of Cuba. It is to be composed, according to a statement of Poey, published in a Havana paper, "of a thick volume of text, Spanish folio, and of an atlas of ten volumes larger folio (eighteen by thirteen inches). The plates are made with a light indication of the colors, which are described in the text. All are original, drawn from nature by the author. . . . The text contains the scientific name of each species, the common name, the complete synonymy, a description of the colors, distinctive peculiarities, relations of the varieties, comparisons, critical observations, and the history of the fish. It contains, moreover, the characters of classes, sub-classes, orders, families, genera, and species. The total number of plates in the Atlas is 1,040. These show 758 species of Cuban fishes, represented by 1,300 individuals in all stages of growth. All except the sharks are drawn of life-size.

"These 758 species, together with 24 mentioned at the end of the work, make up 782 species of Cuban fishes. Of these, 105 are doubtful, and therefore are left without specific names. I hold them in suspense till I can receive further data from the study of other specimens. There are, therefore, 677 species well determined, of which more than half have been first made known by me. Not more than a dozen species in the list have not been examined by me. These are inserted on the authority of writers who claim to have received their specimens from Cuba, and who appear to be worthy of confidence.

"The preparation of the text has cost me an immense amount of time and labor, by the preparatory studies which it has required. In the determination of the species it is rarely that a single one has not occupied me for an entire week. I have wished to make known the certain as certain, and the doubtful as doubtful, so that I shall declare nothing to be new unless it is so in reality."

The manuscripts of this great work are now in duplicate. One copy is retained by Professor Poey ; the other has been purchased by the Spanish Government for $5,000. It is expected and earnestly hoped by Professor Poey and his friends that the Government will soon order its publication, but, unfortunately, there seems to be no certainty of this.

The manuscripts and drawings of the "Ictiología Cubana" were placed on exhibition by the Spanish Government in the Exposition of Amsterdam in 1883. In testimonial of their worth, Professor Poey has received from King William III the decoration of the order of the "Lion Néerlandais." Before this, as the most distinguished of Spanish naturalists, he had received from the King of Spain the title of "Encomendador de la Orden de Isabella la Católica."

Among the manuscripts of Professor Poey, with the title of "Corona Poeyana," is a list which he is sometimes fond of contemplating, of the species of animals which were first made known by him. This list is a long one, longer perhaps than that of any other zoölogist of our times who has confined his studies to a single fauna.

It is a fashion in some quarters to decry the work of the describer of new fauna. All honest study has its equal place, and, till the pioneer work of exact determination of species is performed, there is little opportunity for the embryologist or the anatomist. It is of little use to record the structure or the development of an animal while the animal itself remains unknown.

There is no characteristic of Professor Poey's work more striking than his entire lack of prejudice, or, in other words, his teachableness. A certain zoölogist was once described to me by Dr. Kirtland as "a little man who couldn't be told anything." His character was in this regard just the reverse of that of Professor Poey. Among all the eminent zoölogists of our time, I know of none so ready to learn, whatever the source from which information may come. He has no theories which he is not ready to set aside when a better suggestion appears. Unlike some other systematic writers, he exhibits no preference for his own names or subdivisions, but is as ready, if the evidence seems to require it, to smother one of his own species or genera as those of another.

His work shows no sign of falling off in quality. The clearness of his judgment and the accuracy of his memory seem unimpaired. It is difficult in conversing with him to realize that he was born in the last century, and that in his earlier studies he was a cotemporary of Cuvier and Valenciennes, and of Geoffroy Saint-Hilaire. Most men are older at fifty than Poey at eighty-five.

Poey was married in 1825 to María de Jésus Aguirre. He has had six children. Two of his daughters still reside with him at Havana, and their skillful hands have been of great service to him in the preparation of his drawings and manuscripts.

Poey is rather above the medium height, well-formed, and in his younger days he was remarkably active and vigorous. Even yet, time rests lightly on his shoulders. His complexion is fair, and his hair and eyes are not dark. He has little of the appearance of a Spaniard or indeed of any especial nationality. As he himself has said, "Comme naturaliste, je ne suis pas espagnol: je suis cosmopolite." He is of a happy temperament and has a peculiarly genial and cheery smile. Simple, direct, unaffected, but possessed of a quiet dignity, he is certainly one of the most delightful men I have ever met. Of all men I have known, he has best learned the art of growing old.

EDITOR'S TABLE.

SCIENCE AND THE TEMPERANCE REFORM.

THE Legislature of the State of New York has passed a law providing for the instruction of "all pupils in all schools supported by public money, or under State control, in physiology and hygiene, with special reference to the effects of alcoholic drinks, stimulants, and narcotics upon the human system." Other States have passed similar enactments, so that there seems to be something like a general movement appealing to this new form of influence for the promotion of the cardinal objects of the temperance reform. That movement has relations with various sciences, not only with physiology, but also with sociology, and perhaps some reference to its history will help us to judge of the promise of the new measure.

The bad effects that flow from the excessive use of spirituous liquors, and the evils of drunkenness, have been recognized and deplored in all times. While every literature has its poetry in praise of the cheering influence of wine, so it has its proverbs showing the evil consequences of devotion to the intoxicating cup. But the first organized movement to check the excessive use of intoxicating liquors belongs not only to modern but to very recent times. The temperance reform was inaugurated but a little over half a century ago. Numerous societies were formed, with wide affiliations, to act upon public opinion in the most efficient and persistent manner. There rapidly grew up a copious and varied temperance literature, consisting of explanations of the injurious action of alcoholic liquors, of vivid delineations of the results of the inebriating habit, of statistics of the criminality and pauperism that flow from it, of its enormous cost to the community at large, of impassioned appeals in sermons and lectures, and of poetry and fiction all combined, for the promotion of the philanthropic objects of the temperance associations.

The characteristic of the temperance movement at this early stage was the directness of its personal appeals to influence voluntary action. Individuals were plied with facts and arguments, and on grounds of self-respect and social obligation to abstain from the habit which had its root in the selfish appetites, and bore the fruits of suffering to the victim, calamity to the family, and grave detriment to society. To give the utmost support to voluntary action, the pledge was introduced, which offered the advantage of an explicit written committal, and a public avowal of the purpose of the individual to abstain from spirituous liquors. In short, the policy was to influence persons, by every consideration that could be urged, to the practice of restraint and temperance in the use of alcoholic beverages. The movement was pushed with fervor and zeal, and every expedient resorted to, to gain the result. The pledge in favor of the temperate use of spirituous liquors was changed to a pledge against all use of them, on the ground that moderation, by the laws of human appetite, rapidly passes to excess.

Among the means of influence, Science was, of course, called upon to give its evidence. Prize essays by distinguished medical men on the physiological effects of alcohol were multiplied, and tracts stating the results were sown like autumn leaves through the community. One of the most eminent of the reformers, Mr. E. C. Delavan, after laboring long, and devoting great wealth to the promotion of the reform without the full results which he had anticipat-

ed, acknowledged his discouragement to a sagacious friend, who suggested to him that there was a sure way in which the cause might be made to succeed. "It has been shown," said he, "that the use of alcohol is very injurious to the human stomach. Men care for their stomachs more than for anything else. Prove to them that alcoholic liquors impair and destroy the digestive organs, and your case is won and that work done." Mr. Delavan, accordingly, had prepared a series of colossal lithograph plates, showing the progressive influence of alcohol upon the coats of the stomach, from the first congestion that follows moderate indulgence in the stimulant, onward through the stages of inflammation and disorganization to the final ulcerated condition shown by the *post-mortem* of habitual drunkards. The enterprise was pushed with great vigor. Hundreds of thousands of dollars were spent in the manufacture of these stomach-charts, and they were hung up conspicuously in the halls of court-houses, on the walls of public institutions, and in all places where they could be observed by everybody. That these illustrations did good service there can be no doubt, although able medical men denied their strict accuracy. One effect was to concentrate so much attention upon the stomach that all other parts of the human system were neglected, and this made necessary new scientific expositions, showing that the peculiar and most injurious effect of ingested alcohol is upon the nervous system and the brain.

But, while great good was undoubtedly accomplished by the means adopted, and, indeed, all the good that could be expected from them, the results were still unsatisfactory—that is, the evil of intemperance was not swept from the country as the sanguine reformers had anticipated. The movement was driven as a crusade having a definite end. Attention was so concentrated upon the evils of intemperance that they came to be considered as almost the only evils with which mankind are afflicted. Fervor of feeling grew into heated and passionate partisanship, with impatience of tardy results. There was but little recognition of anything like natural laws in the case, and no admission of the great truth that radical changes in the conduct of human nature must proceed slowly and are limited by many conditions. There grew up a conviction that the temperance movement as thus prosecuted had proved a failure. Men had been instructed, persuaded, and denounced, until it was felt that these agencies had accomplished everything of which they were capable, and it was resolved to push on to more stringent measures. If men could not be induced to abstain voluntarily from the use of intoxicants, then they must be compelled to abstain. Government must be appealed to, to force the results which moral influence had failed to secure. If men would not stop drinking, they must be deprived of the means of drinking, and so it was determined to strike at the trade in alcoholic liquors, and to outlaw it by prohibitory legislation.

The temperance question was thus launched into politics, a change of great import, as it was the virtual abandonment of the policy hitherto pursued. Moral influences were, of course, not openly repudiated, but it remains true that they no longer characterized the temperance movement. The faith in them had departed, and its place was taken by the new faith in the efficacy of political action. We called attention last month to the overshadowing influence of the great superstition that political agencies are omnipotent for the accomplishment of social ends.

In the face of notorious facts, and in the teeth of all experience, we cling to the notion that government can do everything; so that now it is widely believed that a reformation of social habits, involving the strongest appetites,

which it has been impossible to bring about by the most vigorous, prolonged, and comprehensive moral movement of modern times, can still be brought about through the passage of enactments by political majorities.

How far this change went may be further illustrated. In the first stage of the temperance movement the wrong to be righted was on the part of the individual who indulged in drinking-habits. The practice was denounced because held to be intrinsically immoral, self-destructive, and vicious in all its influences. The turpitude and wickedness of the case consisted in the act of indulgence. But, with the change of tactics on the part of the reformers, the point of assault was shifted: the pressure was virtually taken off the party that committed the wrong act, and applied to the commercial transaction that preceded it. The liquor-trade was denounced as the real root of the evil of intemperance, and the men who sold alcoholic spirits were held to be the culpable offenders and the criminals who deserved to be dealt with by punishment like other criminals. Yet the sale of liquors, like the sale of anything else, is a compound transaction—a seller implies a buyer—and they are both voluntary parties to the proceeding. If that proceeding is wrong, both are to be condemned—certainly the one who makes the demand as much as he who supplies it; and, if the partnership transaction is criminal, it is difficult to see why both should not be punished alike. But, in the new aspect of the case, he who drinks is virtually relieved from condemnation, while those who sell him the beverage become the objects of concentrated reprobation, to be punished with the full severity of the law. This fundamental change in the policy of the temperance movement, involving as it does the virtual abandonment of those agencies which are most proper to influence conduct, and which were clearly vindicated in their beneficent working, can hardly be regarded as a step forward in the legitimate development of the temperance movement.

It is in the light of such experiences that we are to consider the measure now brought forward for the further promotion of abstinence from intoxicating liquors.

This measure is a partial reversion to the older method, and may be characterized as politico-educational, with special relation to the scientific aspect of the subject. It is proposed to give instruction in relation to the physiological effects of alcohol, and thus, as has been said, "to play the school-house against the saloon." It may be well to do this, but it will be wise not to expect too much from it. It is a very crude measure, and has been born of temperance zeal rather than any intelligent appreciation of the subject.

In the first place, the action of alcohol and the narcotics upon the human system opens one of the obscurest, and we may add, the most unsettled, of all questions. But little, in fact, is known of the *modus operandi* of these agents upon the nervous system, where they take such special and disastrous effect. School-teachers can not explain it—doctors can not explain it; no two will agree about it. The theories of the behavior of alcohol in the human system have undergone change after change within a generation, and we are probably but little nearer the final solution of the problem than when the first experiments were made upon cats and dogs to solve it.

In the next place, the amount of physiology that is or that can be taught in common schools, and by all the teachers under State control, is grossly insufficient to make intelligible what is known of the physiological effects of alcohol. The crude smattering of physiology got in such schools under ordinary teaching is absolutely worthless as a preparation for understanding the subtile influence of narcotic agents upon

the nervous constituents and the nervous mechanism. What is taught will not be science, which must explain things, only sham science; will not be real knowledge or anything understood, but only the words of a lesson.

No doubt something will be gained by calling attention to the subject, but the question is, if the method proposed is the best that could be adopted. We doubt if the appeal to science through such teachers as we have, and such books as most of those that are now appearing, to meet the new emergency, is the best way of securing the end desired. What is wanted is to make the deepest and most indelible impression upon the minds of youth in regard to the bad effects of indulgence in alcoholic beverages. But the attempt to expound the physiology of the subject is not the best way to accomplish this object. The evils of intemperance are evils which openly appear in conduct. The incontestable facts of the injurious influence of drinking are direct, palpable, conspicuous, observed by everybody, and open to no question. Science can not make them more clear, or add vividness to the painful facts which are seen by all. Good may come, as we have said, but it is a question if more good would not come from the dogmatic statement of facts, that are free from doubt and obscurity, and that are based upon unquestionable and established experience. The subject in its scientific aspects is beyond the grasp of pupils in common schools, but maxims and rules can be stamped upon their minds in a way that will exert a salutary and permanent influence. And if it is desired to teach the young to *think* upon the subject, then let the victims of alcoholic indulgence be taken as *object-lessons*, in which what the pupil sees himself becomes the basis of the opinions he forms. Every community is full of examples of the effects of drinking, and these effects are seen in all possible degrees. Let the scholars be directed to observe for themselves, and see how much truth they can find out on all sides of the subject; the exercise will at any rate be an excellent means of mental improvement and practical education.

LITERARY NOTICES.

GEOLOGICAL EXCURSIONS, OR THE RUDIMENTS OF GEOLOGY FOR YOUNG LEARNERS. By ALEXANDER WINCHELL, LL. D. Chicago: S. C. Griggs & Co. Pp. 234. Price, $1.50.

IN his experience as a teacher of geology, and interested in extending a knowledge of this interesting and important subject in the common schools and among the people, the author of this work found himself confronted with this formidable difficulty, that "in most of our colleges, no knowledge whatever of the subject is required for entrance, and there is no course where geology is a prerequisite; and since geology is not required for entrance into college, it has ceased to be taught in the schools—as if geology had no uses, if not demanded as a preparation for college." As our higher educational system, therefore, virtually works against the recognition of this science, the difficulty must be met by preparing the necessary rudimentary books for introduction into the schools, on the ground of the importance of this kind of knowledge, and with no reference to the influence of the colleges. Dr. Winchell says: "As geology is not taught in the schools, and as nineteen twentieths of our teachers have not studied it in college, there is almost no preparation among teachers of primary or secondary grades to induct a pupil into an elementary knowledge of the subject. The only hope of early reform seems to lie in furnishing teachers with a text-book so framed as to be capable of successful use by a teacher without previous acquaintance with the subject. Certainly, no such text-books exist; for though there are several which might be employed by teachers thoroughly disciplined by previous study, the large majority of our teachers are not so disciplined. These text-books, moreover, are too much conformed to the dogmatic

or didactic method—telling about things which are far away, or, if near at hand, are not identifiable by the aid of the book. Due discrimination is not observed between those conceptions of the subject which are abstract, and beyond the reach of the young pupil or older novices, and those which can be attained through accessible concrete illustrations."

The method of these "Excursions" is practical, and implies the observation and study of geological phenomena as they lie all about us among the most obtrusive and noticeable of the objects which we daily encounter. The author, moreover, informs us that a large part of the "Excursions" has been used while yet in manuscript, in actual trials by actual teachers. This is unquestionably the true method in scientific education, because it makes the mental acquisitions real, and the adoption and extension of this plan of study is unquestionably the great desideratum of the time.

BRAIN-EXHAUSTION, WITH SOME PRELIMINARY CONSIDERATIONS ON CEREBRAL DYNAMICS. By J. LEONARD CORNING, M. D. New York: D. Appleton & Co. Pp. 235.

INTERESTING and valuable as are the investigations that have been made upon questions of muscular dynamics, Dr. Corning believes that the economical questions involved in normal and morbid intellection constitute a field of physiological research that transcends all others in importance. With the growing demands made in the present conditions of society upon the thinking apparatus come factors to exert a prejudicial influence upon the cerebral mechanism; and these have never been more numerous than now, as is proved by the alarming increase of brain disorders during the last few years. Dr. Corning has endeavored to consider a group of symptoms, associated with these disorders, from as scientific a point of view as possible. The opinions he expresses have been formed from direct clinical observation, and from inferences derived from physiology and experimental pathology. In a chapter of "Preliminary Considerations" he discusses the relation of the law of the convertibility of forces to the dynamics of the healthy and the morbid brain; the emotions of the healthy and morbid mind, and memory in its healthy and morbid relations. In the two following chapters are considered the clinics and pathology, and the causation of brain-exhaustion; account being taken in the latter chapter of predisposing and exciting causes, false educational conceptions and methods, the effects of tobacco and alcoholic excesses, and "mental hygienics." The last chapter is devoted to the principles of treatment. Rest is prescribed as the most wholesome and efficient remedy. Drugs are objected to, but coca is prescribed as an excellent remedy against worry, and one which, besides exercising an invigorating effect upon the cerebral centers, "imparts an indescribable sensation of satisfaction." A special treatment by electrization of the sympathetic nerve, with simultaneous bilateral compression of the carotids, is described.

METHODS OF HISTORICAL STUDY. By HERBERT B. ADAMS, Ph. D. Baltimore: N. Murray. Pp. 137. Price, 50 cents.

THIS treatise constitutes the opening double number of the second series of the "Johns Hopkins University Studies" in historical and political science, and includes papers describing improved and special methods of historical study that have been introduced at the university, and at other institutions in the United States and Europe. The main principle of the training at Johns Hopkins is to encourage independent thought and research. Little attention is given to text-books and mere phraseology, but all stress is laid upon clear and original statements of fact and opinion, whether the student's own or a consulted author's. At Smith College the study is pursued by four classes in regular gradation, with liberal use of collateral literary works and historical romances as aids to the lectures and formal treatises. In another paper are given expositions of four new methods of historical study, viz., the topical, comparative, co-operative, and seminary or laboratory methods. In the first method the study is begun with and enlarged from some special topic, preferably from one which is nearest and most familiar. In the comparative method, like phases of history are studied connectedly. In the co-operative method, each student makes a thorough study of a single branch of the subject, and the work of all

is so co-ordinated in the class that each member may, to some extent, reap the benefit of the labors of his companions. The seminary method is adapted from the old scholastic methods of the ecclesiastical and philosophical seminaries, and has been applied in numerous German and some American institutions.

THE BIBLE ANALYZED IN TWENTY LECTURES. By JOHN R. KELSO, A. M. New York: "Truth-Seeker" office. Pp. 833. Price, $3.

WE believe that the Bible should be subject to criticism and investigation, in all its aspects, like any other book; and that the criticism should be searching and fearless. Still, there are proprieties to be observed, even by a critic who does not believe the book the product of divine inspiration. It is a very ancient book, embodying unique historical records and traditions of the earliest times of civilization, the genuineness of which is newly illustrated by every new excavation in the ruined cities of the East; prophetic books and poems which, regarded in the literary aspect alone, are worthy to be ranked with the world's masterpieces; and religious declarations and moral precepts which have been built into the foundations of modern manners. These things should entitle it to respectful treatment, even at the hands of an enemy. Mr. Kelso has not given it such treatment, but has made it the object of persistent ribald, indecent, blasphemous assaults, the very violence of which obscures whatever of force his argument might have had he presented it in a becoming style.

THE BOOK OF THE BEGINNINGS. By R. HEBER NEWTON. New York: G. P. Putnam's Sons. Pp. 310.

IN this little book Mr. Newton gives a study of Genesis, with an introduction to the Pentateuch, conducted according to the canons of free, independent investigation. The study is based upon the lectures which the author, a well-known Episcopal clergyman, had begun to deliver to his Bible-class, but which he discontinued at the request of his bishop. The singular position in which he was put by this event made it seem due, he says, "alike to my people and myself, that the public should be enabled to judge of the real nature of the lectures which had called forth such a very unusual if not unprecedented episcopal interruption of a presbyter in the course of his parochial ministrations." Mr. Newton accepts to the full the results of what is called the "new criticism" with regard to the mode of composition, the time, and the authorship of the five Mosaic books; and while he presents these clearly and in all their force, he does it in the spirit and with the manner of one who accepts, as he avows that he does, the religious teachings of the Bible as authoritative.

THE OUTSKIRTS OF PHYSICAL SCIENCE. ESSAYS, PHILOSOPHICAL AND RELIGIOUS. By T. NELSON DALE. Boston: Lee & Shepard. Pp. 187. Price, $1.25.

THE studies contained in this book seem to be products of a mind much exercised about the relations of religion and modern science. Its author has read widely, and is evidently in much sympathy with the study of natural science, for which he declares he had an early fondness, while he possesses strong religious convictions, and strives with sincerity to bring the two orders of thought into unity and harmony. The second part, on "Scientific Studies: their Place and Use in Education," presents a very fair *résumé* of the educational claims of the sciences, but the author is still in agreement with the classicists, holding that there is nothing like "the humanities" for the cultivation of the mind.

HOME AND SCHOOL TRAINING. By Mrs. H. E. G. AREY. Philadelphia: J. B. Lippincott & Co. Pp. 192.

THE author of this plea for home instruction has made it under the feeling that the subject has at no time received the attention it demands, but that we are coming to neglect it more and more. We are apt to leave the whole matter of the training of our children to the schools, in utter forgetfulness of the fact that the specially important phase of it—that which forms a symmetrical character—is ostensibly ignored in many of them, and that "the most abiding portion of the child's mental seed-sowing has already taken root and given its tints to the soil before the period for entering the school-room arrives." The oversight of "this first lush

growth of the young mind" is the one thing that seems especially given into the hands of the parents, and it is treated by the author as a duty that should be peremptorily observed from the very moment of birth. The subject is handled in all its aspects as by one who is well qualified to do it, and the presentment, both in matter and manner, is admirable.

LECTURES ON THE SCIENCE AND ART OF EDUCATION, WITH OTHER LECTURES. By JOSEPH PAYNE. New York: E. L. Kellogg & Co. Pp. 256. Price, $1.

DR. JOSEPH PAYNE was for many years a distinguished and most successful practical teacher in England, and, retiring from his profession late in life, he continued to devote himself to the subject with great assiduity, and became at this period the first Professor of the Science and Art of Education in the College of Preceptors in London. Dr. Payne was well versed in the history of education, and familiar with the most advanced methods of teaching, and the lectures contained in this volume are the ripe results of wide knowledge and critical experience. The book is full of valuable suggestions and wise practical observations, and will be found very useful to inquiring teachers.

A HISTORY OF TUBERCULOSIS. By ERIC E. SATTLER, M. D. Cincinnati: Robert Clarke & Co. Pp. 191. Price, $1.25.

THE first five chapters of this book consist of a translation of the first part of a work on "Studies of Tuberculosis," by Dr. Arnold Spina, of Vienna, who is a vigorous opponent of the theories of Koch. These chapters present the results obtained from long series of inoculation, inhalation, and feeding experiments, the first of which date back to 1789, bringing the history of the subject up to March, 1882, when Robert Koch published his investigations. In the next chapter Dr. Sattler presents a review of the steps by which Koch arrived at the conclusion that tuberculosis is caused by a specific micro-organism. Koch's announcements set many investigators at work upon tuberculosis and other diseases supposed to be infectious, and many additional discoveries have been published. There are those also who deny many of the discoveries claimed, and even the existence of the *Bacillus tuberculosis*. After giving some account of the controversy, Dr. Sattler says in conclusion: "Whether Koch has been too sanguine in the one direction, or Spina has gone too far in the other, it is not for us to decide. The great number of scientific men engaged throughout the civilized world in repeating these experiments, and in studying their results, will soon sift out the truth of the matter, and bring the question to a final and authoritative decision."

BIOGEN: A SPECULATION ON THE ORIGIN AND NATURE OF LIFE. By Professor ELLIOT COUES. Second edition. Boston: Estes & Lauriat. Pp. 66. Price, 75 cents.

THE substance of this disquisition was delivered as a lecture before the Philosophical Society of Washington, and now appears with the trimmings—dedication, mottoes, preface, introduction and appendix—forming altogether a very lively little treatise on biological mysticisms. Professor Coues seems to have got tired of working under the restraints of observation, analysis, and induction at the mere phenomena of life, as is the work-a-day habit of science, and so he determined to break away and have a spree of speculation, and see what might come of it. He makes a rally for the relief and rescue of the old but declining doctrine of the "vital principle," or "vital force," which he denominates "Biogen," and which he insists is a thing, and a very real thing, "possessed of sensible qualities and attributes which may be investigated by proper scientific methods, and by scientific experimentation, quite as readily as any other of the so-called 'imponderables' of Nature. It is as open to examination as luminiferous ether, and its properties if not its substance may be studied as we may study light, heat, or electricity; it is therefore not only a proper object of science, but a proper subject of philosophy." However this may be, it is certain that the doctrine of the "vital principle" was made the most of in times of ignorance before anything was known of the laws of life. The "vital principle" explained everything in the middle ages, and we observe that the publishers of this *brochure*, doubtless aware of the fitness of things, have printed it in mediæval type.

THE LAND-LAWS. ("The English Citizen" Series.) By FREDERICK POLLOCK, Barrister-at-Law, M. A., etc. London: Macmillan & Co. Pp. 215. Price, $1.

THE land-laws of England, which form the subject of this book, must not be mistaken for the land-laws of the United Kingdom. Scotland has a distinct legal system of her own, with a distinct history; Irish land-law, on the other hand, is nothing but imported English law, with certain modifications, the most important of which have been made too recently, and are too much involved with political questions, to be profitably treated in connection with English institutions. The aim of the author is to make the principles and the leading features of the English law of real property intelligible to a reader who is without legal training, but is willing to take some little pains to understand. "Almost every possible kind of ownership and almost every possible relation of owners and occupiers of land to the state and to one another have at one time or another existed in England, and left a more or less conspicuous mark in the composite structure of the English law of real property." The customary Germanic law, which the Angles and Saxons brought to England, is first taken up; the changes resulting from the Norman conquest are next described; and then follows an account of the legislation through which the modern law has developed. A chapter is devoted to the relation between landlord and tenant, and the book concludes with an examination of some modern reforms and prospects. Several special points are discussed in an appendix.

THE DESTRUCTIVE INFLUENCE OF THE TARIFF UPON MANUFACTURES AND COMMERCE, AND THE FIGURES AND FACTS RELATING THERETO. By J. SCHOENHOF. New York: G. P. Putnam's Sons.

THE contents of this little volume first appeared in communications to the New York "Evening Post," and they are now collected and published by the Putnams for the New York Free-Trade Club. The author of this book seems to believe that the way to develop trade is not to fetter it, and he proves abundantly by copious and varied statistics that the effect of legislative restrictions and congressional control of manufactures and commerce is injurious in proportion to the interference—is destructive rather than properly protective. There is a good deal of excellent sense in this book, and, although it deals chiefly in facts of the statistical kind, it contains many reflections and suggestions that are well worth attention, as, for example, the following:

> The curse of American politics, log-rolling, is also the cause of the absurdities of our "well-balanced tariff." It gave us a system of taxation that grinds every one, does cruel injury to a whole nation of working-people, and good to no one except a few monopolists and tax-gatherers; and it may safely be asserted that the corruption of our politics is largely due to protection, and to the mania for government aid and subsidies engendered thereby. Self-reliance and independence are lost where large profits are more the results of legislative grants extended to industrial enterprises than of unassisted work. The lobbyist seeks, and frequently finds, an open door to executive departments, and it is doubtful whether a civil service can be thoroughly reformed that is constantly exposed to the persistent efforts of the briber. Worse, however, than this corrupting influence upon the civil service is the effect upon legislation and the legislator. The lobbyist, the advocate of special laws, is the greatest enemy of free institutions. When a people loses confidence in its representatives, when, rightly or wrongly, the latter are held in suspicion of being the tools of private interests, then the calamity is irreparable. The briber of an officer of the Government does momentary harm, while unjust laws tax generations with unjust burdens, that are the more galling the more people become conscious of the methods by which were obtained the industrial preferences and the privilege of taxing the masses for the benefit of the few.

POLITICS: An Introduction to the Study of Comparative Constitutional Law. By WILLIAM W. CRANE, and BERNARD MOSES, Ph. D., Professor of History and Political Economy in the University of California. New York: G. P. Putnam's Sons. Pp. 305. Price, $1.50.

THIS book opens with a description of the structure of a nation and of the nature of sovereignty. The basis of every political community is affirmed to be physical force, and the importance of political instinct is insisted upon. Political heritage is illustrated by the history of the English colonies in America. The means by which the will of a sovereign is expressed are next taken up, the tendency of power in the United States and in some European federations is noted, and a chapter is devoted to political parties.

HOUSE-DRAINAGE. By WILLIAM PAUL GERHARD. New York: Durham House-Drainage Company. Pp. 44. SANITARY DRAINAGE OF TENEMENT-HOUSES. By WILLIAM PAUL GERHARD. Hartford, Conn.: Case, Lockwood & Brainard Company. Pp. 40.

IN the former work, the essential features of any thorough system of house-drainage are laid down to be: Extension of all soil and waste pipes through and above the roof; provision of a fresh-air inlet in the drain at the foot of the soil and waste pipe systems; the trapping of the main drain outside of the fresh-air inlet, to exclude the sewer-gases from the house; provision of each fixture, as near as possible to it, with a suitable trap; and provision of vent-pipes to such traps under fixtures as are liable to be emptied by siphonage. In the second pamphlet, the principles of thorough sanitary drainage are applied to the tenement-houses of working-men.

ANNUAL REPORT OF THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION FOR 1883. S. W. Johnson, Director. New Haven: Tuttle, Morehouse & Taylor. Pp. 120.

THE Board of Control of this institution report that the people of the State use the station more and more each year, and that the problem becomes more difficult how best to do the varied work asked for. To provide additional force, Dr. E. H. Jenkins has been appointed vice-director. Two hundred and nineteen analyses of fertilizers have been performed, fifteen of milk, three of butter, with negative results as to adulterations, and twenty of fodders. In connection with the last is given a table showing the average composition of American fodders and feeding-stuffs, compiled from all analyses that could be secured up to the 1st of September last. The chief seed-examinations were on onion-seed.

THE GLACIAL BOUNDARY IN OHIO, INDIANA, AND KENTUCKY. By Professor G. FREDERICK WRIGHT. Cleveland, Ohio: Western Reserve Historical Society. Pp. 86.

THE author began, ten years ago, investigations concerning the kames of the Merrimac Valley in Eastern Massachusetts. Continuing along the line, he has now traced the boundary of the glaciated area from the Atlantic Ocean to the southern part of Illinois. In the present pamphlet, the boundary is described in detail through the several counties and townships of Ohio, with local maps, and as to its general features through Kentucky—so far as it reaches that State—and Indiana.

REAL AND IMAGINARY EFFECTS OF INTEMPERANCE. By G. THOMANN. New York: The United States Brewers' Association. Pp. 167.

THE brewers have at last entered upon an active defense of their calling, against the assaults of the prohibitionists and the temperance orators, and in this pamphlet present their case and an appeal to facts and statistics. They claim that the arguments that have been hurled against fermented liquors are largely the offspring of the imagination, and do not rest on any solid foundation, or on what can be proved; and they publish counter statements and statistics favoring their own side. Leaving distilled liquors to take care of themselves, if they can, they contend that the beverages in which they are interested are wholesome, and are not instigators of crime, and that the use of them serves as a foil and a check to indulgence in stronger liquors; therefore it ought not to be discouraged.

MINERALOGY. By J. H. COLLINS, F. G. S. Systematic and Descriptive Mineralogy. New York: G. P. Putnam's Sons. Vol. II, pp. 329. Price, $1.25.

THE present volume of Mr. Collins's "Mineralogy" is intended to accompany and supplement the first volume, which was published in 1878; and, like that, was written for the use of "practical working miners, quarrymen, and field geologists," as well as of students. The accounts are very brief, but they are clear, and illustrated with distinct drawings of the crystals, and include notices of all the minerals that had been described up to the time of the author's leaving England for Rio Tinto, Spain, in 1881.

REPORT OF THE NEW YORK STATE SURVEY FOR 1883. JAMES T. GARDINER, Director. Albany: Van Benthuysen Printing-House. Pp. 182, with Six Maps.

THE work of the survey was continued through last year in accordance with the matured plan on which it has all the time

been prosecuted, and which is calculated, when completed, to produce an accurate and connected system of measurements over every part of the State. The survey of the Tonawanda and Oak-Orchard Swamps has formed a prominent part of it. We learn from the report that the rainfall in Western New York steadily increased from 1830 to 1880, and that the greatest average rainfall known for a similar period—38·73 inches—was reached during the years from 1868 to 1881, inclusive. The summer flow of the streams has, however, greatly diminished during the last fifty years.

THE TEACHING OF DRAWING IN GRAMMAR-SCHOOLS. A Paper on the Educational Features of the Subject. By WALTER S. PERRY. Boston: The Prang Educational Company. Pp. 26.

THIS essay was read as a paper before the department of Industrial Education at the last meeting of the American Educational Association. It considers the applications of drawing under three heads: as in industrial construction; in representing the appearance of objects and of nature; and in ornamentation. Of these, in the public schools, the first, the application in construction, is the most important. "It forms preeminently the educational and the practical side, and yet it is the one which has usually been ignored, while the picturesque and decorative sides have been given undue importance." It is dwelt upon at length, while the application to representation is treated as complementary to it, and that to decoration as essential to the completeness of the course of instruction.

THE AMERICAN UNIVERSITY. When shall it be? Where shall it be? What shall it be? By JOHN W. BURGESS, Ph. D., of Columbia College. Boston: Ginn, Heath, & Co. Pp. 22. Price, 15 cents.

IN the author's view, the reply to the first question should consist of three conditions. The university shall be when there exists in the nation the surplus of wealth to support it, the body of scholars to form its faculties, and the body of students qualified by previous training and acquirements to profit by university work. These conditions are believed to exist now in the United States. The place for the university should be at or near a center of wealth, education, and refinement, and that exists. The university should not be an institution of the State, but must be a private institution, supported by private donations, and directed by an association of private persons.

ADMINISTRATIVE ORGANIZATION. A Consideration of the Principal Executive Departments of the United States Government, in Relation to Administration. By LL. B. Washington: William H. Morrison. Pp. 108.

IMPERFECTIONS in the workings of the administrative departments of our Government being recognized, the author of this essay seeks a permanent remedy for them by going to the principles on which departmental organization should rest. He finds that administration of the laws applied to the conduct of public affairs may be evil, by defect of the laws: first, where the administrative organization is in false relation with the administrative object; second, when, though the legal relation be perfect, the processes of administration are faulty; third, when both defects exist. The subject is considered prominently in the former aspect. The first-named defect is declared to exist seriously in the Treasury and Interior Departments, and a plan for reorganizing them is sketched.

ANCIENT EGYPT IN THE LIGHT OF MODERN DISCOVERIES. By Professor H. S. OSBORN, LL. D. Cincinnati: Robert Clarke & Co. Pp. 232, with Map.

MOST good works on ancient Egypt are costly, and the knowledge of the subject is growing so fast that even a very recent book is likely to require to be added to or modified within a short time after it is published. Professor Osborn has endeavored to put what is really known of the history in such a brief form as to embody it in a really accessible book; to sift out what is conjectural and obsolete; and to include the results of the latest researches up to the time of his writing. He has been a diligent student of the monuments and inscriptions in the European museums and in their native land, has kept himself abreast of the literature of the subject, and has endeavored to present the results of matured studies. The work of later years is mentioned, in-

cluding the discovery of the royal mummies near Thebes, and the excavations of M. Naville at Pithom-Succoth, or the latest that had been done till excavations were begun at Zoan last March. Dr. Osborn's style is not always happy, and his references to the work of later investigators are frequently not so clear as the reader would desire them to be.

BILATERAL ASYMMETRY OF FUNCTION. By G. STANLEY HALL and E. M. HARTWELL. Pp. 17.

THE subject relates to supposed differences, essential or casual, in the power of similar organs on the different sides of the body; as, between the right and left eyes, ears, arms, or legs, or the right and left sides of internal organs. Numerous observations by different investigators are noticed briefly, and then the present authors describe their own experiments. From them they draw the conclusions that every deviation from perfect bilateral symmetry of form or function is to be accounted for without recourse to occult causes of any sort; that the key to the entire bilateral problem which shall reveal a common principle for all the various paired organs is to be sought in the study of bilateral muscle tension, the only act of will; and that the solution of this problem, when reached, will probably shed light on the nature of consciousness.

THE RAILROAD AS AN ELEMENT IN EDUCATION. An Address before the State Teachers' Association of Texas. By Professor ALEXANDER HOGG, M. A. Louisville: Printed for the Author.

THIS brief pamphlet is filled with a great deal of interesting railroad information, its predominant idea being that railroads are a great factor of civilization, and help on the work of general amelioration and improvement in many ways. There is a brief sketch of the course of inventions that prepared for railroad constructions, some examination of the public influence of transcontinental railway systems, some defense of railroads against charges of monopoly, some account of the great "breakwaters" of the world, and finally an argument in favor of the construction of such a work at Galveston, in Texas, that shall give it deeper water and improve it as a seaport.

A MANUAL OF PSYCHOLOGICAL MEDICINE AND ALLIED NERVOUS DISEASES. By EDWARD C. MANN. With Phototype Plates and other Illustrations. Philadelphia: P. Blakiston, Son & Co. Pp. 699. Price, $5.

THIS comprehensive treatise aims to "present the subject of insanity and allied nervous diseases in a scientific, clinical, and forensic light, and in so concise a form as to be available for the student and general practitioner." It is therefore addressed to the profession as a manual of medical practice, and a systematic text-book of medical education. Physicians must, therefore, be the best judges of its adaptation to their wants, but the work bears evidence throughout of matured knowledge, wide experience, and assiduous, painstaking labor. But while the work is thus designed for the uses of medical men, such is the profound interest and great importance of the questions which it discusses, that in many aspects it will be found instructive and valuable to general readers who are concerned with the great question of the conditions and causes of insanity, and the hygienic precautions that are needed for the maintenance of soundness and integrity of mind. Dr. Mann is evidently no extremist and no alarmist, but he recognizes that mental derangement in various forms is undoubtedly on the increase, and that its extension can be checked only by the widest diffusion of knowledge upon the subject, and some corresponding improvement in those habits of life which are promotive of mental deterioration. Dr. Mann emphasizes in his preface a most important fact, which is too generally overlooked, when he points out the long interval of time that may elapse between the slight initial perversions of cerebral activity and the distant consequences that often result from them. It is too commonly thought that if pupils leave school without becoming lunatics outright, all the talk about mental over-exertion amounts to nothing, yet we have here to do with causes and effects that work slowly, and require time for their full disclosure. Dr. Mann says:

> A very important point relating to the prevention of mental disorders and the modern nervous diseases is, that the growth of mental function is as gradual as that of bodily power, and that brain-tissue degenerations and mental diseases may be

separated by long intervals of time from the too premature and intense stimulation of the brain in school-children which causes these nervous diseases. We meet with the preponderance of nervous diseases in the refined and cultivated classes, where, by premature and stimulating processes of education, there has been forced an elaboration of brain-structure, hastening the functional activity of the brain, with no due regard to the law of evolutional precedence. Normal growth and development will give us healthy minds, while a structurally degraded centric nervous system, or an altered quality of blood, and secondary disturbance of nerve-function, will antagonize healthy mental manifestation. If we have want of sleep, a defective generation of nerve-force, an unstable condition of the nerve-centers, an incomplete development of any part concerned in mental action, all of which Dr. Blanford, of England, has ably shown to be causes of mental disease, we can not expect healthy mental function. Alcohol and opium are to-day responsible for much deterioration of brain. Dipsomania and the opium-habit being on the increase among Americans, there is a greatly increased nervousness and an increasing inherited disposition to the different neuroses; and the condition known as cerebral hyperæmia, an increase in the quantity of the blood within the capillaries of the brain, or rather one form of it, of vaso-motor origin, resulting from overwork and mental strain, is greatly on the increase.

THE TREATMENT OF WOUNDS AS BASED ON EVOLUTIONARY LAWS. By C. PITFIELD MITCHELL, Member of the Royal College of Surgeons. New York: J. H. Vail & Co. Pp. 29. Price, 50 cents.

WE recently called attention to the lectures of Dr. Hughlings Jackson, before the Royal College of Physicians in London, on the bearings of the law of evolution upon diseases of the nervous system, and in the monograph before us the principle of evolution is followed out in another field of medical practice. The author published a short essay in 1882, in "The New York Medical Journal," in which he "endeavored to find in the Spencerian doctrine of evolution the foundation of a satisfactory theory to guide us in the treatment of such wounds as are inflicted in the more common operations of surgery." The present pamphlet is a further extension of that view. We can only say here that the case is very strongly presented, and will repay the attention of those medical students of a philosophical turn of mind who care for those deeper elucidations and explanations of the living organism which the development theory is now so successfully affording.

TRUTHS AND UNTRUTHS OF EVOLUTION. By JOHN B. DRURY, D. D. New York: A. D. F. Randolph & Co. Pp. 140. Price, $1.

THIS volume consists of the Vedder Lectures delivered in April, 1883, before the students of the theological seminary and Rutgers College at New Brunswick. As might be expected, the author's interest in the doctrine of evolution depends entirely upon its relation to theology. He recognizes that there is some truth in it, which consists in that part that he can conform to the requirements of his theology. He will take evolution as a plausible hypothesis, not yet established as a truth, and which may be a help to scientific progress even if erroneous. He will accept it under theistic interpretation, or as "many Christians hold in conjunction with their faith in God and the Bible."

Dr. Drury examines the definitions of evolution, and, finding them unsatisfactory, remarks: "If I were to formulate a definition of evolution, such as the present condition of our knowledge warrants, it would be this: 'Evolution is that hypothesis which supposes the process by which the present diversity in nature has been reached to have been one of progression; the more complex and better endowed proceeding in accordance with laws imperfectly known out of simpler and lower forms.'"

Undoubtedly the laws will become more perfectly known, and then this germ of a definition will grow into greater completeness. Dr. Drury's book, though emanating from a mind in a state of anxious transition, and beset on all sides with difficulties, is, nevertheless, readable and instructive.

PUBLICATIONS RECEIVED.

Inebriate Automatism. By T. D. Crothers, M. D. Hartford, Conn. Pp. 9.

Filtrations of Saline Solutions through Sand. By William Ripley Nichols. Boston. Pp. 12.

Earthquake Measurement. By J. A. Ewing, B. Sc. Tokio, Japan: Tokio Daigaku. Pp. 92, with Twenty-four Plates.

The Eastern Pioneer of Western Civilization and the Recognition her Efforts receive. By C. S. Eby. Tokio, Japan. Pp. 52.

The Sufficiency of Terrestrial Rotation for the Deflection of Streams. By C. K. Gilbert. Pp. 8.

Osteology of Ceryle Alcyon. By R. W. Shufeldt, U. S. Army. Pp. 15, with Plate.

The Subsidence Theory of Earthquakes. By Samuel Kneeland. Boston. Pp. 8.

Report on the Exhibits at the Crystal Palace Electrical Exhibition of 1882. By Ensign Frank J. Sprague. Washington: Government Printing-Office. Pp. 169, with Plates.

Okadaira Shell-Mound at Hitachi. By I. Iijima and C. Sasaki. Tokio, Japan: Tokio Daigaku. Pp. 7, with Eleven Plates.

Chicago Manual Training School, First Annual Catalogue. Pp. 16.

Evolution and the Positive Aspects of Modern Thought. By W. D. Le Sueur. Ottawa, Canada: A. S. Woodburn.

The Offices of Electricity in the Human Body. By H. B. Philbrook. New York. Pp. 31.

Washington High-School; Syllabus of the Courses in Botany and Zoölogy. By Edward S. Burgess. Pp. 39.

Wages and Tariffs. By E. J. Donnell. New York: Wilcox & O'Donnell. Pp. 47.

"The American Monthly," June, 1884. Chicago, Ill.: American Magazine Publishing Company. Pp. 100. 35 cents, $4 a year.

State Mineralogist, California, Third Annual Report. Sacramento: James J. Ayres. Pp. 110.

Silver-Lead Deposits of Eureka, Nevada. Abstract of report by Joseph Story Curtis. Washington: Government Printing-Office. Pp. 24, with Map and Plates.

The Conventional Lies of Civilization. From the German of Max Nordau. Chicago: L. Schick. Pp. 365. $1.

Society for Ethical Culture, Chicago. First Annual Report of the Relief Works. Chicago: Max Stern & Co. Pp. 40.

Tokio Daigaku. Calendar for 1882–'83. Tokio, Japan: Z. P. Maruya & Co. Pp. 142.

Notes on the Volcanic Rocks of the Great Basin. By Arnold Hague and Joseph P. Iddings. Pp. 12.

Volcanic Sand at Unalashka, Alaska. By J. S. Diller. Pp. 4.

Arithmetical Aids. In box. Boston: Houghton, Mifflin & Co. 20 cents.

Eleventh Cincinnati Industrial Exposition, 1883. Report of Board of Commissioners, W. W. Peabody, President. Pp. 312.

Naphthaline as an Insecticide, etc. By Dr. Thomas Taylor. Washington. Pp. 6.

Fibrine and Bacteria. By Thomas Taylor. Washington. Pp. 5.

"American Psychological Journal." Quarterly. Edited by Joseph Parrish, M. D. Philadelphia: P. Blakiston, Son & Co. 1883. Pp. 450. $2 a year.

Alabama Weather Service, May, 1884. Montgomery, Ala. Pp. 9.

Taxation in the United States, 1789–1816. By Henry Carter Adams, Ph. D. Baltimore: N. Murray. Pp. 80. 50 cents.

Criminal Responsibility of the Insane. By Orpheus Everts, M. D. College Hill, Ohio. Pp. 22.

Meteorology and Soil Temperatures at Houghton Farm. By D. P. Penhallow. New York: "The Hub." Pp. 41, with Plates.

The Urine in Disease. By C. F. Taylor, M. D. Philadelphia: "The Medical World." Chart.

Testing Machines. By Arthur V. Abbott. New York: D. Van Nostrand. Pp. 190. 50 cents.

Symbolic Algebra. By Professor William Cain. New York: D. Van Nostrand. Pp. 131. 50 cents.

List of Water-Works. Compiled by J. J. R. Cross. New York. Pp. 8.

The Diet Question: Giving the Reason Why. By Susanna W. Dodds, M. D. New York: Fowler & Wells Company. Pp. 99. 25 cents.

The Hollanders in Nova Zembla. By Daniel Van Pelt. New York: G. P. Putnam's Sons. Pp. 120. $1.25.

Cottages; or, Hints on Economical Building. Compiled and edited by A. W. Brunner. New York: William T. Comstock. Pp. 54, with Twenty-two Plates. $1.

Discoveries of America to the Year 1525. By Arthur James Weise. New York: G. P. Putnam's Sons. Pp. 380, with Map. $4.50.

Tokology: A Book for Every Woman. By Alice B. Stockham, M. D. Chicago: Sanitary Publishing Company. Pp. 277. $2.

The Essentials of Anatomy, Physiology, and Hygiene. By Roger S. Tracy, M. D. New York: D. Appleton & Co. Pp. 299.

Observations on Vitality of Seeds of Weeds, and Certain Diseases of Grasses. Massachusetts State Experiment Station, Amherst. Pp. 12.

Manual of the Mosses of North America. By Leo Lesquereux and Thomas P. James. Boston: S. E. Cassino & Co. Pp. 447, with Six Plates.

The Laws of Health. By Joseph C. Hutchison, M. D. New York: Clark & Maynard. Pp. 223.

Introduction to the Study of Modern Forest Economy. By John Croumbie Brown, LL. D. Edinburgh: Oliver & Boyd; Montreal: Dawson Brothers. Pp. 228.

U. S Commission of Fish and Fisheries. Report for 1881. Washington: Government Printing-Office. Pp. 1,146.

La Fábula de los Caribes (The Fable of the Caribs). By Juan Ignacio de Armas. Havana: Francisco S. Ibañez. Pp. 31.

Fridolin's Mystical Marriage. By Adolf Wilbrandt. Translated by Clara Bell. New York: William S. Gottsberger. Pp. 240.

POPULAR MISCELLANY.

The American Association.—The Philadelphia meeting of the American Association will begin September 4th, under the presidency of Professor J. P. Lesley. The sectional Vice-Presidents are: A. Mathematics and Astronomy, H. T. Eddy, of Cincinnati; B. Physics, John Trowbridge, of Cambridge; C. Chemistry, John W. Langley, of Ann Arbor; D. Mechanical Science, R. H. Thurston, of Hoboken; E. Geology and Geography, N. H. Winchell, of Minneapolis. Biology, E. D. Cope, of Philadelphia; F. Histology and Microscopy, T. G. Wormley, of Philadelphia; H. Anthropology, E. S. Morse, of Salem; I. Economic Science and Statistics, J. Eaton, of Washington. The Permanent Secretary is Professor F. W. Putnam, of Cambridge; General Secretary, Alfred Springer, of Cincinnati; Assistant General Secretary, E. S. Holden, of Madison, Wisconsin; Treasurer, William Lilly, of Mauch Chunk, Pennsylvania. The British Association has invited the members of the American Association to join in the meeting at Montreal, and the American Association and the local committee of Philadelphia have invited the members of the British Association and their companions

to take part in the Philadelphia meeting. Receptions will be given at the Academy of Music and the Academy of Fine Arts; a garden-party at Haverford College; and a microscopical exhibition at the Academy of Natural Sciences. Botanical excursions will be organized, and a special meeting for botanists held by the botanical section of the Academy of Natural Sciences; and other interesting visits and excursions will be made. The address of Professor Young, as retiring President of the Association, will be delivered on the evening of the 4th, at the Academy of Music, and will be followed by a reception to members of the Association and their invited guests. The headquarters of the Association will be at the Academy of Music, Broad Street.

Sir John Lubbock on Classical and Scientific Education.—Sir John Lubbock spoke, at a recent dinner of the British University College Club, in reference to the great advance that had been made in this age in education. A commission of inquiry, appointed in 1861, mentioned as a great practical evil of the English schools that too little time was devoted to modern languages, and science was practically excluded altogether. A similar commission in 1864 gave substantially the same verdict. A third royal commission, in 1875, declared that the practical omission of these subjects from the training of the middle and upper classes was little less than a national misfortune. Still, though no doubt some progress had been gained, too little attention was given to these subjects. The time in the schools was at present allotted somewhat on the average as follows: To science, not more than two hours a week were given; to modern languages, three hours; and to geography, arithmetic, and mathematics, four hours, leaving thirty hours for Latin and Greek. Now, suppose that six hours were devoted to arithmetic and mathematics, six to science, six to modern languages and history, and six to geography, there would still be more than twenty hours for Latin and Greek, and if a boy could not learn Latin and Greek in twenty hours a week, spread over ten years, he would certainly never learn them at all. Sir John Lubbock was far from undervaluing Latin, and indeed it seemed to him well worth considering whether the present system of learning it was really wise, and whether our sons ought not to be taught to speak it as well as to read it. He then spoke of the particular importance of the knowledge of modern languages and science in England. Englishmen have the most varied enterprises all over the globe, more than half the shipping on the high seas, and foreign investments returning them $350,000,000 a year. The management of these gigantic undertakings ought to be intrusted to those who could speak the language of the country in which they were carried on. Many a promising concern had been brought to ruin because it had been impossible to find properly qualified Englishmen to take care of it, and because it had consequently been intrusted to foreigners. He did not undervalue and would not neglect the classics. All he asked was that science and modern languages should have their fair share of attention, for, as Dr. Carpenter had well observed, there was one side of our nature which science was the only means of cultivating.

The Weather, Health, and Crime.—Mr. S. A. Hill has recently published, in "Nature," an analysis of the effects of the weather upon the death-rate and crime in India, particularly in the Northwest Provinces and Oude. The whole number of deaths varies enormously from year to year. Thus it was 1,914,499 in 1879, and 987,190 in 1880, showing a difference of nearly a million in two successive years. The average yearly rate is about a million and a half. Taking the two years of extremes cited, in 1879 the monsoon rains were unusually heavy, while in 1880 they were extremely scanty, and apprehensions of famine were entertained. The year 1877 was also dry and healthy. The first rough generalization suggested by Mr. Hill's tables is, that dry years are healthy and wet ones unhealthy. It would, nevertheless, be wrong to infer that in India mortality is due to rain, for the figures for the several months show that, as a rule, the month in which fewest deaths occur is July, which happens to be just the rainiest month of the twelve. Rain is, no doubt, one of the indirect causes of death;

but it operates by inducing malaria, which does not come with it but after it. Mere rise in temperature, as shown by monthly means, appears to have comparatively little effect. The variations in the diurnal range have a much greater effect, while the change in the death-rate, due to varying humidity, is even less than that due to temperature changes. The relation between the death-rate and the movement of the wind is inverse. In October and November, when malarial diseases prevail, the air is almost absolutely still, and a little wind would probably go a good ways toward dissipating malaria. The deaths by small-pox are fewer in the months when the general mortality attains its maximum. The meteorological causes favorable to the spread of this disease appear to be heat, drought, and possibly also an unusually high wind-velocity. The maximum mortality from cholera usually occurs in the rainy season. Whatever may ultimately prove to be the nature of the disease, there can be little doubt that in the Northwest Provinces it is, to a great extent, dependent upon heat and moisture. Crimes by violence seem to be proportional in frequency to the tendency to *prickly heat*, an excruciating condition of the skin induced by a high temperature combined with moisture.

The Morality of Happiness.—If any proof of the truth of your remark, that "there can be no manner of doubt that rules of conduct are regarded by an immense number of persons as essentially associated with religious doctrines," were needed, it may be found in the fact that many people will but half-heartedly admit that a man may be capable of good conduct if he does not profess their own peculiar creed, but will stoutly deny that such conduct is possible to him who professes no creed at all. The reason for this position is, I think, not far to seek. That conduct conduces to happiness is, perhaps, more conclusively insisted upon in the Bible than in any other book that is equally read; and those who regard the Bible as the inspired fount of their theology can not admit that a man may by his life prove this and yet not give his adhesion to their own or some kindred doctrine which they insist is built upon biblical teaching. But that this proposition—"Conduct conduces to happiness"—is true, most people, indeed, I should say, all people, may prove to themselves by a little thoughtful introspection. Who, without any reference whatever to religious sentiments, has not felt the pangs of remorse, when suffering from a sense of wrong-doing? Who has not felt a thrill of the most real and satisfying pleasure when, by the exercise of self-denial, he has conferred some benefit on a fellow-creature—thus receiving from his own conscience the direct assurance that the proposition is true? Yet conscience existed before the Bible, and before the Bible must have been susceptible of the same emotions that influence it now. It so happened that the Jews made the discovery, some centuries ago, that "conduct conduces to happiness," and insisted upon it in their literature; and it further happened that upon Jewish literature the whole fabric of Christian theology was built up; but the truth and proof of the proposition are matters of purely worldly wisdom, the outcome of experience, and have nothing whatever to do with theological dogmas.—*A. McD., in Knowledge.*

Flat-foot.—Flat-foot is an acquired deformity, characterized by a flattening or falling down of the inner longitudinal arch of the foot, a structure on which depend the form of the foot, the distribution of the weight of the body over it, and the grace and ease of walking connected with the rising forward on the toes. Its cause may be found in any condition that disturbs the natural equilibrium between the weight transmitted to the arch and the power of the fibrous and muscular structures to sustain the pressure. It comes on about puberty, or between puberty and full manhood, particularly in persons exposed to long standing, carrying heavy weights, or other modes of straining the arch, and in those whose tissues are weak at that point. Besides the deformity and the loss of elasticity in the step and of all ease and grace in walking, it causes great pain, which, naturally, is always worse after standing or walking, especially after going up-stairs or up-hill, and at night than in the morning. In very severe cases the heel becomes raised, giving the

foot what Professor Ongston has called a canoe-shape. The success of any treatment of the deformity depends largely upon the age and extent of the affliction and the ability of the patient to conform to the surgeon's directions. It includes prolonged rest, the avoidance of standing still, the exhibition of tonics, the adaptation of boots to the requirements of the case, with the application of devices to raise and support the arch or bring the other parts of the foot into proper position, with, sometimes, surgical operations. Professor Ongston, availing himself of the advantages of Listerism, has ventured, with success, upon the bold operation of rearranging the bones of the foot in their proper position and plugging them together with ivory pegs.

The True and False in Mesmerism.—The physiologist, says the "Saturday Review," holds that some of the phenomena of mesmerism are genuine and comparable to certain natural states, but that none exist to justify the supposition of any unknown force or effluence, most mesmeric manifestations of a certain sort being entirely due to individual or collusive fraud. For most of the facts alleged are of such a nature that it is infinitely more probable that all connected with them, both actors and reporters, are deliberate impostors, than that they themselves should be true. The careful study of the alleged phenomena by those who are alone qualified to report on them has over and over again negatived all shadow of evidence that a person in the state called hypnotism, somnambulism, or mesmerism, has any power whatever of being influenced in any way by another to perform *specific* actions, all possibility of previous hints or impressions being excluded, while demonstrably apart from all methods of communication by the senses. That in many cases the mind may act abnormally most are aware, and spontaneous counterparts are found in disease to the real phenomena of hypnotism. Artificial somnambulism, indeed, is practically undistinguishable from the somnambulism which is called disease; and it is mainly true to regard the psychological fields of these phenomena as identical. In this state the brain acts, as it were, fitfully; some of its functions sleep while others wake, and in various combinations the actions of the senses are heightened or lowered, or apparently for a time abolished. But in no instance of this artificial somnambulism that has been admitted to be genuine has there been any justification for supposing a special effluence from the operator; and innumerable counter-experiments have been made on hypnotic subjects who have promptly fallen into this condition from merely believing that some force was being exerted. Every hypnotic phenomenon can be more or less obviously referred to morbid conditions of the nervous system and to abnormal reaction or response to suggestions and other stimuli from without. Illustrations of this are not far to seek. We know that lunatics, out of harmony as they are with their own environment, often imagine themselves to be other people, especially kings and queens. So do the subjects of hypnotism at the suggestion of external surroundings; in the one case the morbid condition is temporary, in the other often permanent. The explanation, then, of the phenomena in question, is to be sought not in the person of the mesmerizer or operator, or in any unknown force, but in the subject "mesmerized." The common element of mesmerism and spiritualism, and it is indeed a large one, is really fraud and fraud alone. Of what remains, the genuine fact of hypnotism, it must be repeated, that it is amply recognized by scientific observers.

Nickel-Plating in the United States.—"Nickel-plating," says Mr. William H. Wahl, in a paper read before the Chemical Section of the Franklin Institute last November, "is an American industry, in the sense that it was first practiced on a commercial scale in the United States, and here received that practical demonstration of its usefulness that has since made it the most successful and most widely practiced branch of the art of electro-plating." It first came into prominence about ten years ago, and has developed into an industry of great magnitude, and acquired a popularity which is easily accounted for by any one acquainted with the use and the excellence of nickel-plated articles. Its growth has been favored

by the success which Mr. Joseph Wharton has attained in the production of metallic nickel of suitable purity at a reasonable price. Mr. Wharton was one of the first to work the metal successfully, and exhibited at Vienna, in 1873, samples of axles and axle-bearings, and at Philadelphia, in 1876, a remarkable series of objects of wrought-nickel. He produced in his works, between 1876 and the close of 1882, 1,466,765 pounds of the metal, the principal source of supply of which was from the ores at Lancaster Gap, Pennsylvania. The earliest practical process for nickel-plating in the United States was patented by Isaac Adams, Jr., in 1869. He devised a bath of the double sulphate of nickel and ammonium and the double chloride of nickel and ammonium, with anodes of metallic nickel, in which iron was combined, to obviate the bad effects of copper and arsenic impurities. The extensive application of this process was facilitated by the production of nickel of improved qualities of purity, and the introduction of dynamos for producing the electric currents, they taking the place of the expensive galvanic battery. Edward Weston, in 1878, prepared a solution containing boric acid, with the double sulphate of nickel and ammonium, the superiority of which is generally recognized. The deposited metal is almost silver-white, dense, homogeneous, and tenacious, while the solution maintains a uniform, excellent working quality. Among other solutions which have been introduced, one prepared by adding ammonia and water to the sulphate of nickel, is recommended by Professor Böttger, and is said to be well suited for the purposes of amateurs, because of its giving good results with a platinum anode. Compositions containing sulphate of nickel and ammonium and sulphate of ammonium are recommended for coating several different metals. Where the double sulphate of nickel and ammonium is used, the bath should be maintained as nearly neutral as possible; but it may be either slightly acid or slightly alkaline. The strength of the current should be carefully regulated according to the surface of the articles in the bath, or the work will be apt to "burn," when the metal is precipitated as a dark-gray or black deposit. To obviate this difficulty, a plate of nickel presenting considerable surface is suspended from the rods by which the objects to be plated are held in the bath, to divert the surplus of the current from them. Other things being equal, the slower the rate of deposition, the more adherent and tenacious the coating of deposited metal will be. Success in plating depends very largely upon the perfect cleansing of the articles before they are immersed in the bath; and this is more important in case of plating with nickel than with other metals, for which the solutions are generally more alkaline. As nickel-plated articles can not be burnished on account of the hardness of the deposited metal, they should be thoroughly polished before being exposed to the bath. A good coating of nickel properly laid on preserves great durability.

A People who can not make Fire.—The Papuans of the Maclay coast of New Guinea are represented by the Russian explorer, Dr. Miklucho Maclay, as being in the most primitive stage. They are wholly unacquainted with metals, and make their weapons of stone, bones, and wood. They do not know how to start a fire, though fire is in use among them. When the traveler asked them how they made a fire, they could not understand his question, but they regarded it as very amusing, and answered that when a person's fire went out he got some of a neighbor, and, if all the fires in the village should go out, they would get it from the next village. Some of the natives represented that their fathers and grandfathers had told them that they remembered a time, or had heard from their ancestors that there was a time, when fire was not known, and everything was eaten raw. The natives of the southern coast of New Guinea, having no iron, shave themselves now with a piece of glass. Formerly they shaved with flint, which they could sharpen quite well, and used with considerable dexterity.

The Art of Early Rising.—The proper time to rise, says the "Lancet," is when sleep ends. Dozing should not be allowed. True sleep is the aggregate of sleeps, or is a state consisting in the sleeping or rest of all the several parts of the organism. Sometimes one and at other times another part of the body, as a whole, may

be the least fatigued, and so the first to awake, or the most exhausted, and therefore the most difficult to arouse. The secret of good sleep is, the physiological conditions of rest being established, so to work and weary the several parts of the organism as to give them a proportionally equal need of rest at the same moment; and, to wake early and feel ready to rise, a fair and equal start of the sleepers should be secured; and the wise self-manager should not allow a drowsy feeling of the consciousness or weary senses, or an exhausted muscular system, to beguile him into the folly of going to sleep again when once he has been aroused. After a very few days of self-discipline, the man who resolves not to doze, that is, not to allow some sleepy part of his body to keep him in bed after his brain has once awakened, will find himself, without knowing why, an early riser.

Reafforesting of Ireland.—At the suggestion of Dr. Lyon, M. P. for Dublin, Mr. D. Howitz, Forest Conservator of Denmark, has made an examination of the resources and the need of Ireland for forest cultivation, and his observations and conclusions have been embodied in a parliamentary report. He has found that "swamps and morasses are created in Ireland from the want of trees to drink up the superfluous moisture. Irish rivers inundate the districts they traverse because there are no forests on the mountain-tops to arrest and retain the autumn and spring rains. In summer there is a dearth of water because the trees are gone which would have served, each, as a reservoir. . . . Irish agriculture, by its system of straight drains, which Mr. Howitz entirely disapproves, has acted as if water were poison instead of nutriment. In the past by felling the mountain-woods, and in the present by planting no successors, it has done worse by tapping the supply at its source. Irish fruitfulness is gradually being drained and washed away into the lakes and seas, and no preparation has been made to replenish it." Yet the island presents the especial conditions for rendering forestry easy and beneficial. Five million of its twenty million acres are waste, and might be planted with a reasonable certainty of profit; and these lands would grow valuable timber, instead of the commoner and cheaper kinds. The list of available trees includes thirty-six conifers, thirty-eight deciduous and hard-wood species, and eight sorts of bushes. Mr. Howitz has drawn up from personal inspection a scheme for planting a hundred thousand acres every year for the next thirty years. By the end of that time a plantation, he estimates, will come to full productive capacity, besides having already given incidental returns from brush-wood and saplings. The cost per acre, at the end of thirty years, will have been, at the highest, £20, or $100; while the lowest annual profits are computed, at present prices, at one pound, or five dollars per acre; and as the demand for timber is all the time rising, and the area of supply narrowing, they are likely to be higher.

The Training of a Medicine-Man.—The medicine-man among the Indians of French Guiana, who is called the *piaye*, is priest, doctor, wizard, and mountebank, chiefly the last, all in one. He prepares himself for his office by going through a course of special training, full of terrible experiences, to which he submits willingly for the sake of the advantages he expects to gain. The candidate, who is supposed to have had some kind of a call to the office, must obligate himself to submit, without flinching, to all the processes of discipline that are to be imposed upon him. Except for a little instruction in the concoction of poisons, the discipline has no reference to the medical art. For six months he is put upon a diet of manioc, which he must feed himself with his feet, using his hands only to guide his feet to his mouth; then he is allowed dried fish, to be taken in the same way, and tobacco, of which he must swallow the juice. Having survived this for a year, he is "examined" by being held under water till he is almost strangled, and then made immediately to walk over red-hot coals, deliberately. Another year of the former regimen is given him to prepare for his second examination, when he is tied up in a bag full of red ants, previously well shaken to a pitch of savage excitement. He is next treated to a most ingeniously devised application of wasp-stings, and to a trial of snake-bites, against which he is permitted

to fortify himself with antidotes. He may also be hung to a flexible rod by hooks stuck in his ribs, or by his thumbs and toes, and kept awake for a week at a time. After this course, he is permitted to assist his master by beating the drum around the sick man's hammock, and howling to drive away the evil spirits. His final trial is the drinking of a decoction of carrion and tobacco-juice, after which he is regarded as fully qualified to work upon the fears of the tribe, and extort from them all the service and tithes and tribute, and levy all the black-mail his victims can be forced to pay. As for medical treatment, there is none of it, not even the herb-doctoring; and this constitutes the chief advantage of the system.

Treatment for Inebriate Patients.—At the last meeting of the American Social Science Association, T. D. Crothers, M. D., read a paper in which he stated that, by a strange shifting of events, insanity, which was supposed to be a spiritual affection until a comparatively recent date, is now studied as a physical disorder; while, inebriety, which was regarded as a disease twenty centuries ago, is still invested with the superstition of a spiritual origin. If it were a moral disorder, it would diminish with the growth of morality and intelligence, but, notwithstanding the advance in these directions, it is rapidly increasing. The revenue returns for twenty years bring out this fact clearly. In 1862 the revenue collected from liquors was six millions; in 1882 it had reached eighty-six millions, an increase far beyond that of the population; yet this does not indicate the enormous increase in sales by the local dealer, of which there are no records. The law assumes the correctness of the theological theory of inebriety, which affirms it to be a vice. The remedy, of course, is punishment by fine and imprisonment, which never cures or prevents drinking, but, on the contrary, weakens and enfeebles the victim, rendering him less curable. Very much in the same way, the punishment of insanity and witchcraft always made its victim worse. The hygienic influences of jails and prisons are wanting in every respect, and adverse to any general healthy growth of body and mind. The only compensation to the inebriate is the removal of alcohol, and the state, in doing this, most terribly unfits him, and makes him more helpless for the future. The hereditary nature of many cases of inebriety is well established. It is estimated that over sixty per cent of all inebriates inherit a defective brain and nerve organization. Moderate drinking always leaves an impress on the next generation. In heredity from inebriety there is transmitted a special nerve defect, which, from certain exciting causes, will always develop into inebriety, or one of its family group of disorders—consumption, insanity, pauperism, criminality, etc. Another form of injury that is obscure, but equally prominent as a cause of inebriety, is mental shock, that is, the effect of sudden grief, alarm, loss, sorrow, or other depressing emotion, which brings on a form of nervous derangement that finds relief in the narcotic effect of alcohol. Children from inebriate, insane, or defective parents require a special education. It is a fact beyond all doubt that the education of today, applied irrespective of the natural capacity of the person, and along unphysiological lines, literally destroys and unfits a large class for healthy and rational living. Probably the largest class of inebriates in this country is without means of support. Dr. Crothers recommends that this class should come under legal recognition, and be committed to workhouse hospitals located in the country. These hospitals should be training-schools, in which medical care, occupation, and physical and mental training could be applied for years, or until the inmates had so far recovered as to be able to become good citizens and self-supporting.

Old-World Origin of the American Indians.—M. Dabry de Thiersant, a French author, has published a book on the "Origin of the Indians of the New World and of their Civilization," in which he asserts that "everything authorizes the supposition that the New World was peopled, at an epoch difficult to determine, by colonies of the Mongolian race, coming over by way of Behring's Strait or of the Aleutian Islands." They were followed by the immigration of another race which played an important part in the development of American civili-

zation, an Aryo-Turanian race, from Scythia. The author describes the probable steps of these immigrations, and assigns the part the Aryans took in the construction of the ancient civilization of the country, in plausible conjectures, which, however ingeniously drawn and stated, lack the essential quality of being known facts. He might, however, have had some substantial foundations on which to rest his hypotheses, had not the Spanish conquerors taken the pains to destroy all the monuments and records they could place their hands upon.

The Mask-Dances of New Ireland.—Herr Weisser, who has recently been cruising in the South Sea Islands, has communicated to Dr. Bastian some interesting facts respecting the use of masks by the savages of New Ireland and some of the neighboring islands. A kind of feast of masks takes place once a year, in the early days of May, and is made an occasion when hostile tribes meet each other in peace for that day only —and, possibly, for finding pretexts for another year's hostilities. Tribes that are neighbors are constantly at war with each other, and hardly a week passes but some person of one of the tribes is killed and eaten by members of another. Such is the course of life through the year, till the festival of peace and masks. During this time the brave carves out, adorns, and paints his mask according to his own notion, and generally with considerable artistic skill. Hence the masks in a large tribe will exhibit a great variety of patterns. Great care is taken that no one shall see the mask, for it is very important that the identity of the owner shall be concealed. When the work is finished, the owner puts his mark on it, and takes it to the mask-house. When the time comes for the parade of the masks, the champions put them on, having arrayed themselves for the occasion in red shirts of bark, and skirts reaching to their knees. They then go out armed to the neighboring tribes, giving notice of their approach by the blowing of conchs and the beating of their wooden drums. When the hostile tribe is reached, the mask-dance is executed with a set of extraordinary movements, and then they all fall to eating together, not without some restraint, for instances of treachery have been known in which poison was concealed in tempting looking sago-cakes. Peace lasts till night, when the masks are inspected, compared, criticised, and jeered at with every manifestation of contempt. The last part of the proceedings excites mutual anger, and furnishes the occasion for the next year's hostilities.

Why we walk in Circles.—The reason that, when lost or not able to see, we walk in a circle, is still undetermined. Mr. George H. Darwin believes that it is because we are right or left legged, our "leggedness" being generally the converse of our "handedness," and that therefore right-handed men, being left-legged, are most apt to deviate to the right, and left-handed men to the left. Himself and Mr. Galton and others, making personal experiments in walking blindfolded, found themselves describing circles not more than fifty yards in diameter, to the right. Of eight schoolboys, six, who were totally right-handed, strode longer from left to right than from right to left, hopped on the left leg, and rose in jumping from that leg; one boy pursued the opposite course; and the last walked irregularly, with no average difference between his strides. Walking on a match for straightness, the left-legged boys all diverged to the right, the seventh boy to the left, and the eighth won the prize. Measurements of Mr. Darwin's own stride, and of the strides of his friends, showed the same connection between divergence and comparative length of stride. Mr. Thomas Hawksley believes that the reason for the divergence is to be found in differences in the length of the legs, not enough to affect the visible step, but sufficient to reveal itself in a considerable walk.

Siberian Superstitions.—A Russian officer, who has spent several months in that region, has given a curious picture of the Yarchans, or the people of Yarkino, in Northern Siberia, who, while in the organization of their communal life they conform quite closely to the Russian system, have so little communication with the world that they still remain almost in a primitive condition, and the grossest superstitions prevail

among them. When the moon is eclipsed, they think it is bewitched; they regard green trees as living and having souls; and they consider sickness a kind of foreign, baleful element that has intruded itself into the organism. Sleep is conceived to be something apart and independent of the body, and the idea of disturbing sleep is incomprehensible to them. They think that, if a man has sleep, he will keep on sleeping in spite of all that can be done, but that, when sleep has left him, the slightest movement will arouse him. They believe in spirits of the wood, and of the tree, fire, house, and bath, not with the abstract, half-belief of the Russian peasant, but with a full confidence in their existence as practical realities. "I am convinced," says the Russian officer, "that the Yarchan peasant is accustomed to begin nothing without previous incantations and mysterious manipulations. Father Wood-Spirit is besought not to drive away the squirrels during the hunt; the spirit of the bath is asked for permission to go into the bathing-place; and the Yarchan is not willing to go to his bath alone for fear of being troubled by the spirit. So permission is asked of the wood-spirit before felling a tree. All petitions of this kind are accompanied with peculiar symbolical formulas. Incantations are in use for the gun, in behalf of the cattle, against diseases, and for every occupation of the day and hour. Of course, there is little room for rational medicine among such a people, and incantations, holy water, and amulets are chiefly relied upon to meet the effects of bewitching. A wizard's cap was formerly set up on the road leading to Yarkino, to prevent the entrance of plagues and witches. The town clerk had it taken away, and the whole community complained of the act to the official board. A wood-fire—that is, a fire that has been kindled by rubbing two sticks together—plays an important part as a prophylactic against infections and all kinds of disease. When an epidemic breaks out, the use of matches is forbidden, all fires are extinguished, and a new wood-fire is kindled in the street, whence all the household fires must be replenished. If, while this is going on, any fire is lit by means of matches or flints, the procedure is vitiated, and has to be gone over again from the beginning.

Virchow on the Origin of Bronze.—At the recent meeting of the German Anthropological Society in Treves, Professor Virchow spoke on the origin of the bronze age. Some archæologists supposed that the composition of the bronze alloy was discovered at different places and in different times independently of one another; but against this view was the fact that the composition of the bronze found everywhere, from the Caucasus to the Pillars of Hercules, is identical—nine parts of copper to one of tin. Considering the question of original discovery, the speaker did not regard the evidence in favor of the claim of the Phœnicians as strong enough to justify the ascription of the honor to them, though they may have been active as spreaders of bronze. Hochstetter's theory that the metal was the property of the whole Aryan race, and had been their common possession before they left their Asiatic home, was opposed by geographical and archæological considerations. Nevertheless, Professor Virchow believed that the civilization of Central Europe was the development of Aryan influence.

The Ideal Zoölogical Garden.—Mr. Theodore Link protests, in "The American Naturalist," against the usual arrangement of zoölogical gardens. As distinguished from menageries, or "shows," the object of zoölogical gardens, according to the constitutions and by-laws of most of them, is the study and dissemination of a knowledge of the natural habits of the animal kingdom. To fulfill this definition, the gardens should furnish opportunities for the study, "and these the disappointed zoölogist seeks in vain. In fact, in this respect, the zoölogical garden of to-day affords but few more advantages than any of those traveling shows that come here every season. . . . I have simply found that an animal, as closely confined as most of them are in zoological gardens, retains none of its natural habits; it only exists—a mere automaton; and even this existence is seemingly under protest. Therefore this aforesaid 'study and dissemination of a knowledge, etc.,' is 'a delusion and a snare.'" In the zoölogical gardens, as he conceives it, "the foremost condition will be the rational construction

of inclosures—not cages—liberal in extent, and in strict accordance with the respective habits and instincts of the animals to be confined. Cages can not well be avoided by traveling menageries; in zoölogical gardens they are inexcusable." In the landscape features of a zoölogical garden, the aim should be to unite beauty with use. The surroundings should imitate, as near as the climate permits, the scenic characteristics of the homes of the various specimens. "This would be a pleasant delusion to both visitor and animal. These widely different styles of scenery should, of course, be blended into a harmonious and well-balanced composition by a very guarded and gradual transition, thus affording delightful surprises at every step."

The One Hundred Cataracts of the Iguazu (South America). — One of the most remarkable systems of waterfalls in the world is described by Herr Gustav Niederlein, who last year made an exploration of the Paraná River into the Argentine province of Misiones. The falls are called the One Hundred Cataracts of the Iguazu, a stream which at that point defines the boundary between the Argentine Republic and Brazil. The river, which is about three miles wide at a short distance above, falls from the Albert Archipelago in a three-quadrant arc, which is compared with that of the Victoria Falls, a descent of about one hundred and seventy feet. The falls appear in three divisions, called the Brazilian, Island, and Argentine Falls, or as Herr Niederlein prefers to style them, the Emperor Dom Pedro, the Emperor William, and the General Roca falls. The first excel in grandeur, the last in beauty, while the Emperor William falls, less extensive, and situated between the other two, impinge upon the handsomely wooded Emperor William's Island. The Dom Pedro Fall plunges a sheer depth of forty or fifty metres into a narrowly contracted basin, whence flows the Brazilian arm of the Iguazu, into which farther down the island-cataracts pour their masses. The bow-shaped Argentine Fall is broken into two stages, the upper one of which is divided by the interposition of a rocky mass into two minor bows, so that it is really a kind of triple fall. This triple cataract feeds the smaller Argentine arm of the river, which joins the Brazilian arm farther on. Not far from these falls the stream receives from the Argentine side the two Bosetti Falls, which, issuing from side-clefts, throw their water-masses over a ledge, about fifty feet high, upon a rocky platform, whence they immediately plunge into the Iguazu. Still below these are fourteen smaller falls, and, finally, the Prince Bismarck Cataract, which falls with a descent broken into two falls, about one hundred and twenty-five feet into a gulf fringed with the primitive sub-tropical forest. About ten miles below this, the Iguazu, now about six hundred and sixty feet wide, unites with the Paraná.

The Southern Andes and Patagonia.— Dr. Karl Martin, of Jena, has recently published a description of the Patagonian wilderness and the lower Andes, from his own observations. The Andes do not stretch in a continuous chain to Cape Horn, as is often supposed, but are broken south of Central Chili by several interruptions. Down to the volcano of Villarica, in south latitude 39°, they are a solid range; but below that peak the mountains fall far below the sixteen thousand feet which it attains. From its southern slope the Shoshuenco River, the chief affluent of the Valdivia, penetrates the mountains through a pass of only about thirteen hundred feet above the sea, receiving its water from a lake which is separated only by a low ridge from the waters of the Limai, a stream flowing into the Atlantic. The mountain standing between this and the next pass of three thousand feet in height is 8,700 feet high, while south of it are lower mountains, between which a number of little known but not very elevated passes lead into the Patagonian highland. A view from the hills surrounding the city of Osoruo shows a number of considerable mountains with no connecting ridge between them, and, in the south, a chain of three peaks. One of these peaks, the shapely cone of the volcano of Osoruo, rises from between two lakes, into one of which flows from the east the Puella, a stream whose source is in the glacier of the Tronador, ten thousand feet high. Near it and separated by a pass of only twenty-nine hun-

dred feet high, flows the Rio Frio from another glacier, into the Nahuelhuapi Lake, the largest lake in Patagonia, from which the Limai, the principal river of the country, flows to the Atlantic Ocean. The chain of the Andes is again broken at this point by a deep gorge; and the passes continue to diminish in height as we go south. The idea that the Patagonian Andes form a continuous marked boundary to the table-land of the country is a mistaken one. The line is frequently broken by ravines that reach far back into the interior; and Captain Simpson, of the Chilian marine, has found the sources of two of the principal western rivers not far from the center of the country. At other points the sea makes extensive cuts into the land, forming deep bays and fiords, between which the land pushes out its sharply serrated peninsulas. Archipelagoes, in which Simpson has counted more than a thousand islands, lie before and within the bays. The largest of the islands is Chiloe; a few of them are level, but most of them are mountainous and steep, while all are thickly wooded. The coast-lines are sharply indented, and the slopes in the neighborhood of the Straits of Magellan, those of Cape Froward, Tierra del Fuego, and Cape Horn, with whose cincture of evergreen beeches the verdant mantle of the Patagonian wilderness descends to the sea, are very rugged.

Effect of Sewage on River-Water.—Franz Hulna has examined the water of the river Oder above Breslau, in its course through the city, and for fourteen kilometres, or about ten miles, below the town, to determine the effect of sewage upon its purity. From the point where the water-supply of Breslau is pumped up to a little above the town, the water undergoes a slight but appreciable deterioration, but after filtration is quite suitable for domestic uses. In passing through the city a continuous change for the worse takes place, which is manifested by the increase of oxidizable matter and of chlorine, and by a hundred-fold augmentation of ammonia and albuminoid ammonia. Microscopic examination disclosed the abundant presence of organisms of putrefaction. Farther down was observed a gradual process of self-purification by contact with oxygen, along with the co-operation of vegetable and animal life in the stream. At fourteen kilometres below the city the influence of sewage could not be detected, either by the chemical or the microscopic examination; but the water was of the same composition as at the supply-station above.

NOTES.

At the June meeting of the Iowa Academy of Science, the president, A. R. Fulton, exhibited specimens of native copper, found in the drift of Iowa, which were in all respects similar to the native copper of the Lake Superior region. In his accompanying paper, Mr. Fulton accounted for their occurrence in this situation by saying that the Lake Superior region was undoubtedly their original home, and that they had been transported by the ice-stream of the Glacial epoch, which apparently at some time had flowed in a southwesterly direction. The occasional finding of fragments of the common sulphate of lead in the drift, southwest from the lead-region about Dubuque, would indicate the same movement.

Professor Moerta, formerly director of the observatory at Santiago, Chili, died at Dresden, Saxony, April 2d, in the fifty-ninth year of his age. He was born near Cassel, and educated at Marburg. He went to Chili, where our Gilliss was making observations on the solar parallax, in 1850, and eventually participated in the observations. When Gilliss returned home in 1852, the Chilian Government put him in charge of the observatory. He also held a professorship in the university. He returned to Europe in 1865, charged with a commission by the Government to purchase a telescope, but did not go back to Chili on account of his health. His observations are embodied partly in the "Annales de la Universidad de Chile" and partly in the "Astronomische Nachrichten."

M. J. P. L. Girardin, a French chemist of considerable distinction, died early in June, in the eighty-third year of his age. He was for thirty years Professor of Chemistry applied to the Arts in Rouen, where he made special researches in fertilizers, and introduced improvements into the processes of the manufactures carried on there that proved to be of great importance. He was afterward a dean of the Faculty of Lille, and rector of the Academy at Clermont. He published some considerable works, the most important of which was his "Lessons in Elementary Chemistry" in five volumes.

DR. LEE, of England, asserts that carbolic acid is the best substance for disinfecting the air, because, when combined with water and boiled, it evaporates with the steam in a constant ratio, so that the steam contains the same relative quantity of the acid as the water from which it is evaporated. Consequently, the acid can be evenly distributed to the air in a constant and exactly regulated proportion, a property which no other equally efficient disinfectant possesses in so perfect a degree.

MR. CHARLES WATKINS MERRIFIELD, F. R. S., whose especial field was in mathematics and the exact sciences, died at Hove, England, January 1st, aged fifty-six years. He was for many years Honorary Secretary of the Royal Institute of Naval Architects. He became Vice-Principal of the South Kensington School of Naval Architecture and Marine Engineering in 1867, and was afterward made principal of that institution; and was Vice-President of the Mechanical Section of the British Association in 1875, and President of the same in the following year. He made the report of the Association on the stability and propulsion of sea-going ships in 1869; was President and Treasurer of the London Mathematical Society; and was an author and editor of mathematical textbooks.

ACCORDING to the estimates of botanists, trees are capable of very long life. De Candolle gave the age of an elm at 335 years. The age of some palms has been set down at from 600 to 700 years; that of an olive-tree, at 700 years; of a plane-tree, at 720; of a cedar, at 800; of an oak, at 1,500; of a yew, at 2,880; of a taxodium, at 4,000; and of a baobab-tree, at 5,000 years.

AN electric light has been put in the lighthouse on Razza Island, at the entrance to the harbor of Rio de Janeiro. It has an intensity of 120,000 carcels, or sixty times that of the best oil-lamp. It is visible by its reflection in the sky, so visible as to attract the attention of those who were not aware of its existence, for a distance of thirty-five miles, or three miles and a half beyond the farthest point at which it can be seen by direct vision, and for a mile farther out to those who know where to look for it.

TRAVELERS have sometimes told of swarms of lepidopterous insects appearing on vessels at sea at certain distances from the coast of South America, and have supposed that they were brought from the pampas by the southwest wind, called the *pampero*. Dr. Fromont, of Brussels, has given an account of a swarm consisting of several varieties of insects that made their appearance when the wind was blowing against the coast, and had to be accounted for in some other way. On looking into the hold, there were found, among the bananas and other fruits with which the vessel was loaded, many remains of chrysalises and chrysalises ready to burst; and it was obvious that the insects had been developed in the cargo. Larvæ of coleopterous insects are also believed to be packed with the dried meat that is shipped from Buenos Ayres, and to give rise, in due time, to other unpleasant appearances.

M. NEFEDOT has received a gold medal from the Natural Science Society of Moscow, for his account of a flint-implement factory found by him in the Vetlouga district, government of Kostroma, the first establishment of the kind of which remains have been discovered in Russia. He has collected six thousand specimens of cut flints and other objects of the stone age, including articles in bone and clay. They are all remarkably primitive in character and form, and none polished.

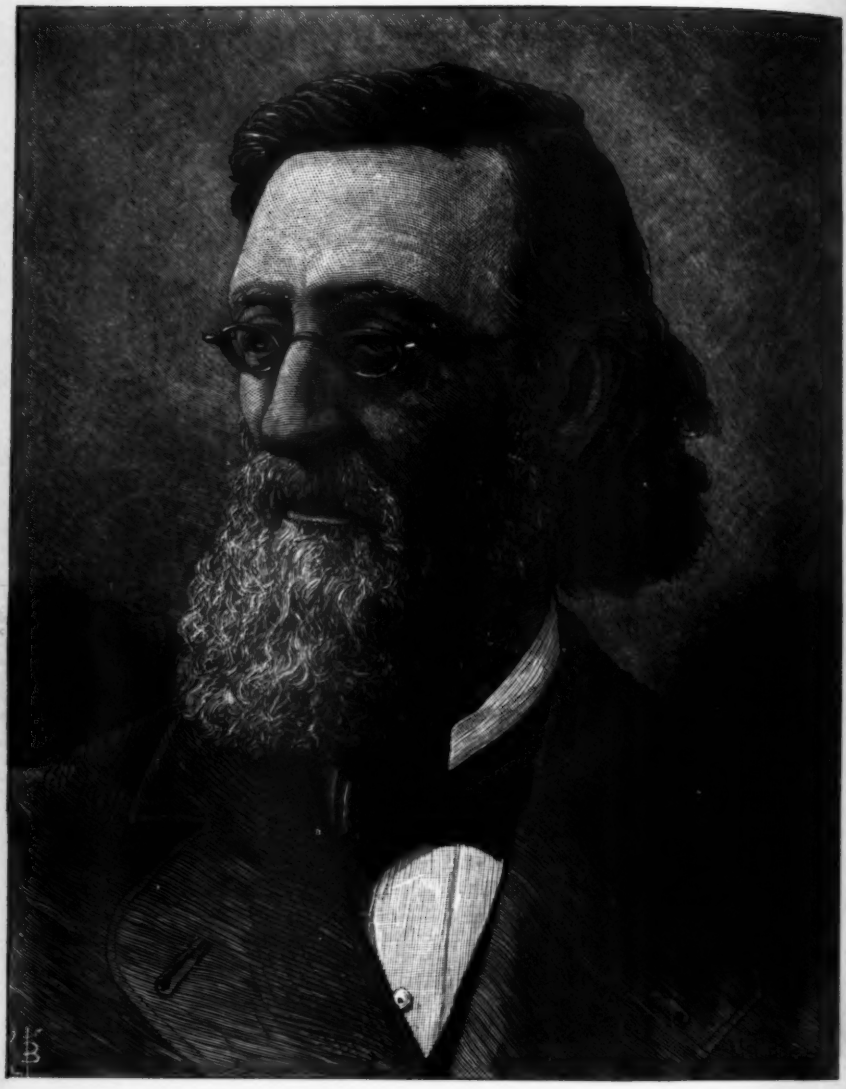
SPECIMENS of paper and pasteboard made from the old moss of the Scandinavian bogs have been offered in the markets. The pasteboard is as hard as wood, and is easily painted and polished; and it is believed to have, for certain purposes, advantages over wood, of which it has the best qualities without the faults. It does not split or warp. Under the hydraulic press it acquires a consistency and a resisting power much superior to what can be given to pasteboard of straw.

SIR JOSEPH FAYRER, President of the British Medical Society, is authority for the story that in nearly every Himalayan village the native baby is placed in a trough into which a stream of water is constantly trickling. This falling upon the vertex of the cranium induces sleep, in which children will lie in their troughs for hours, while their mothers are at their work.

AN Assyrian record of a transit of Venus in the sixteenth century B. C. has been deciphered by Professor A. H. Sayce.

THE Harvard students have now had the direction of Dr. D. H. Sargent in their physical training, and the use of the Hemenway Gymnasium, over four years. The averages of the relative development and strength of the ten strongest students using the gymnasium each year, computed from Dr. Sargent's elaborate tests and measurements, show a rapid advance during this period:

	Age.	Weight.	Development.	Total strength.
		Kilos		
1880	21·6	72·2	528·7	655·2
1881	21·1	73·9	583·7	676·9
1882	20·9	69·4	526·9	654·8
1883	21·1	71·8	583·2	693·4
1884	21·6	70·8	541·4	1018 0



J. PETER LESLEY.